RAIL FLEET ASSET MANAGEMENT PLAN

Department of Subways

Capital Programs

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MTA New York City Transit

NYCT DOS RAIL FLEET ASSET MANAGEMENT PLAN

Version 1.0 | May 2006 – R160 Purchase

Version 2.0 | September 2010 – R160 Completion; R188 Award

Version 2.1 | January 2011 – Second Ave Subway Requirements

Version 3.0 | October 2012 – R179 Purchase

Version 4.0 | September 2017 – R211 Purchase; Evolution of RFAMP

Version 4.01 | May 2018 – Updates to SMS Plan; R179 & R211 Purchases

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Chapter 1 PLAN INTRODUCTION

1.1 Purpose

The Rail Fleet Asset Management Plan (RFAMP) is the strategic planning document for the Metropolitan Transportation Authority (MTA) New York City Transit's (NYCT) Railcar Fleet. The RFAMP is updated for each new fleet purchase and submitted to the Federal Transportation Administration (FTA) for reporting requirements. The RFMP was first produced in 2006 and was updated in 2010, 2011, 2012, and 2018 to reflect changes in NYCT's railcar purchasing plans. The last RFAMP was submitted in May 2018 as part of the R211 grant funding purchase.

The updated plan includes the purchase of the new fleet R262/R268 for scheduled replacement of the R62 fleet as well as the R68/R68A fleet. In addition, an updated summary on the progress of the CBTC program is discussed.

The Rail Fleet Asset Management Plan describes NYCT's policies and procedures for maintaining, rehabilitating, and replacing its revenue cars (referred to as "railcars" for the purposes of this document). It outlines anticipated future service growth and system expansion projects along with their impacts on future railcar requirements. It defines the resources required for short-term and long-term management of the railcar fleet, including annual maintenance costs and future capital investments. The RFMP also documents railcar maintenance procedures, service planning processes, and fleet purchasing forecasts.

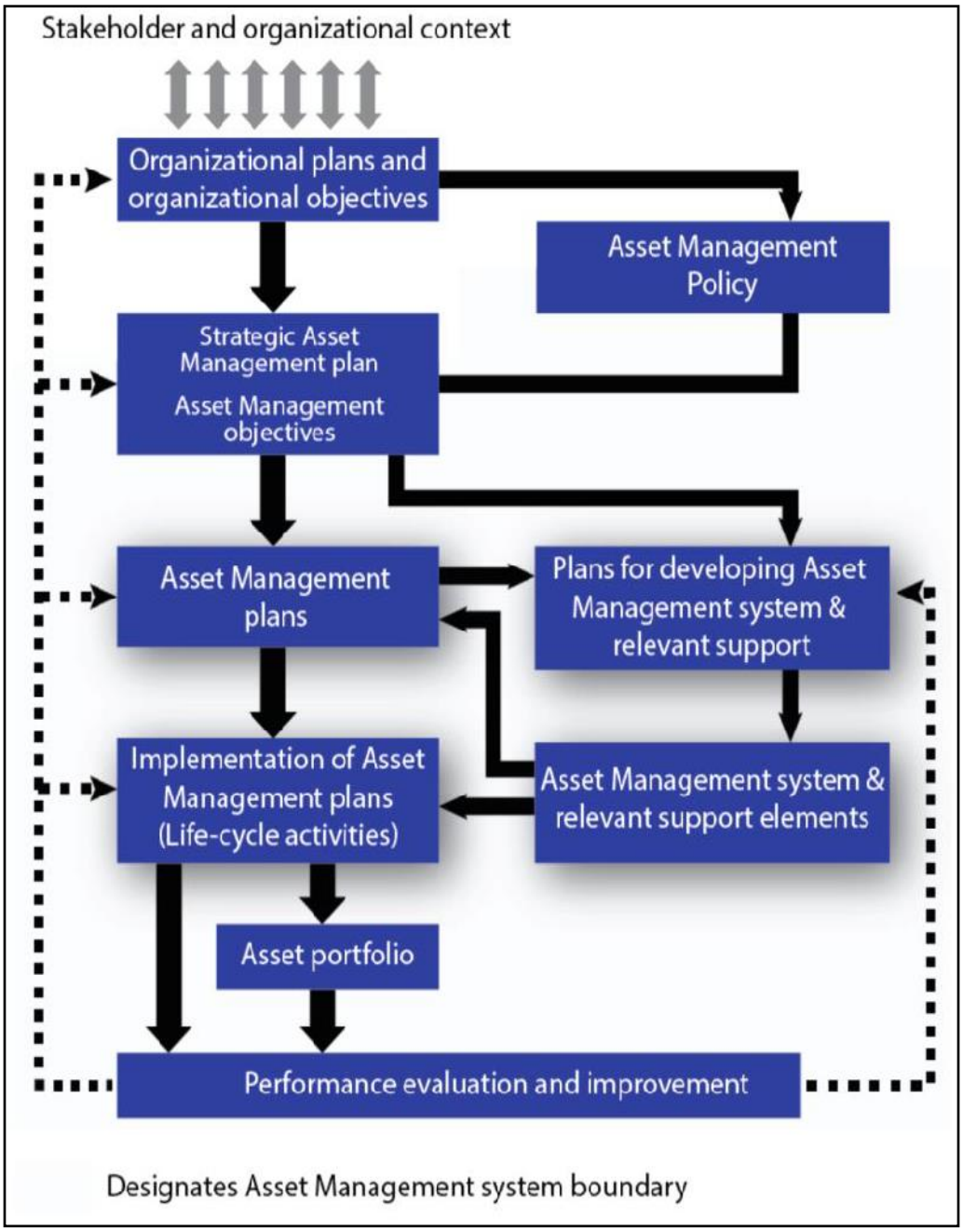
The RFAMP also supports MTA NYCT's Twenty-Year Needs Assessment and identifies NYCT's short and long-term asset management goals for railcars, in accordance with MTA corporate objectives and Enterprise Asset Management (EAM) principles.

1.2 NYCT Asset Management Background

As the MTA continues to adopt principles of asset management across its business functions, NYCT's Department of Subways (DOS) is implementing on the development of individual Asset Management Plans to guide and inform efficient full lifecycle management of DOS assets. Accordingly, the RFAMP represents an evolution of the previous RFMP as NYCT and DOS continue to develop mature asset management processes. This and future versions of the RFAMP will take a more comprehensive approach to railcar asset management, including consideration of full lifecycle costs, performance goals and metrics, etc. This expanded purview is also in compliance with ISO-55001 standards and the FTA's MAP-21 requirements for Transit Asset Management (TAM) plans.

Following an Asset Management Guide has allowed NYCT to increase productivity, reduce costs, optimize resource allocation, and improve transparency and stakeholder communications. Asset management plans provide vision and guidance for present and future decision-making. The mission of the MTA is to preserve and enhance the quality of life and economic health of the region it serves through the cost-efficient provision of safe, on-time, reliable and clean transportation services.

Figure 1 Alignment of Asset Management Plan in ISO – 55001


Stakeholder and organizational context
Organizational plans and organizational objectives
Asset Management Policy
Strategic Asset Management plan
Asset Management objectives
Asset Management plans
Plans for developing Asset Management system & relevant support
Implementation of Asset Management plans (Life-cycle activities)
Asset Management system & relevant support elements
Asset portfolio
Performance evaluation and improvement
Designates Asset Management system boundary

The asset management system aligns with Subway's Vision for 2023 to provide the following:

Focus and Improve Performance

Improve performance today, with a focus on the basics, bringing real improvements to customer services every day.

Modernized Accountable Operations

Invest in improvements that make Subways a future-ready organization leveraging technology, new management practices and organizational changes to be responsive, efficient and customer focused.

Create a Customer Focused Environment

Our customers deserve an environment that is focused on them. Working with partners across the MTA we will improve the delivery of customer service.

Support Capital Investment

The historic MTA 2020 Capital Plan includes tremendous investment in the Subway network, and we need to make sure we support the delivery of those projects, efficiently, safely and with our customers and employees in mind.

Engage our People in our Success

Our people are our most important asset, and we will continue to invest in their success, engage them in our mission, and develop them to be the leaders Subways needs.

The Rail Fleet Asset Management Plan is divided into the following sections:

Chapter 1: "Plan Introduction" includes background information on the purpose, goals, and approach of this Rail Fleet Asset Management Plan.

Chapter 2: "Asset Overview" provides a summary of the NYC Subway system, railcar fleet, and components of the railcars.

Chapter 3: "Service Planning" outlines recent ridership trends and current levels of service. It also includes agency service planning guidelines, forecasts of future service growth and fleet requirements, and a discussion of capacity constraints affecting the subway system.

Chapter 4: "Lifecycle Management: Maintenance & Replacement" describes major elements of the railcar lifecycle, including procurement, inspections and maintenance, normal replacement, disposal, fleet growth, and storage. It includes the latest forecast of fleet purchases and retirements through 2035, in accordance with the service forecasts outlined in Section 3.

Chapter 5: "Financial Summary" outlines the resources required to support the tasks described in Section 4, including capital costs of new procurements and operating costs of maintenance, inspections, cleaning, and other activities.

Chapter 6: "Asset Management Practices" describes the resources involved in managing railcars throughout their lifecycle, including a description of the agency's organizational structure, as well as tools and systems used to direct workflows and manage inventory.

CHAPTER 2 RAILCAR ASSETS

2.1 Operating Environment: An Overview of NYC Subway

The New York City Subway is the busiest heavy rail rapid transit system in the United States, the busiest in the Western Hemisphere, and is amongst the top 15 global systems by total ridership. Prior to the Covid-19 pandemic, 2019 average weekday ridership was 5.5 million. Daily ridership dropped to fewer than 500,000 per day at its lowest point in the early pandemic. By mid-2023 average paid ridership recovered to 3.9 million, 68% of pre-pandemic ridership. With changing work patterns, the recovery on midweek days (Tuesday – Thursday) has been somewhat stronger, at about 70%.

Figure 2: Annual Subway Ridership 1990 -2022

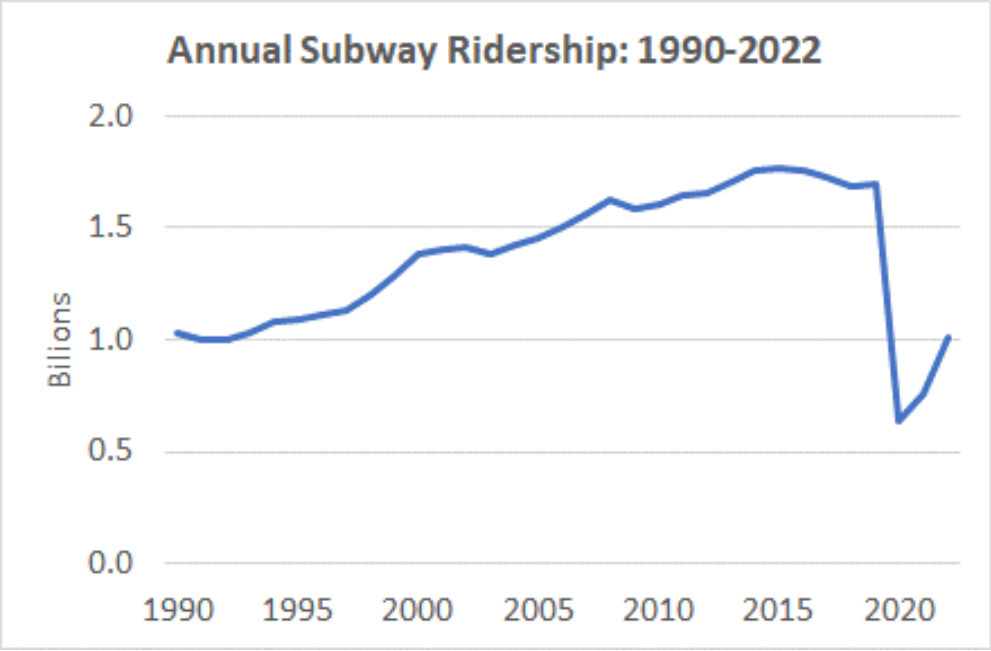


Figure 3: Average Daily Subway Ridership since July 2020

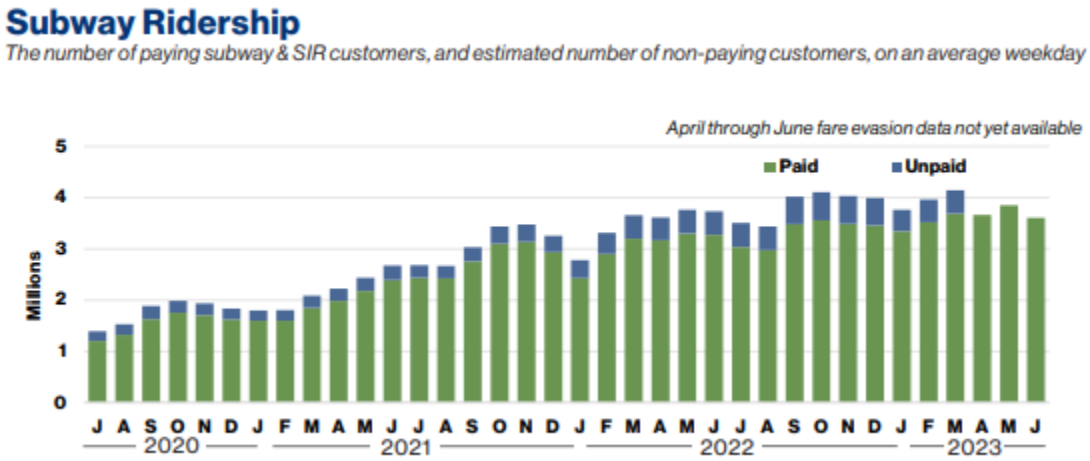
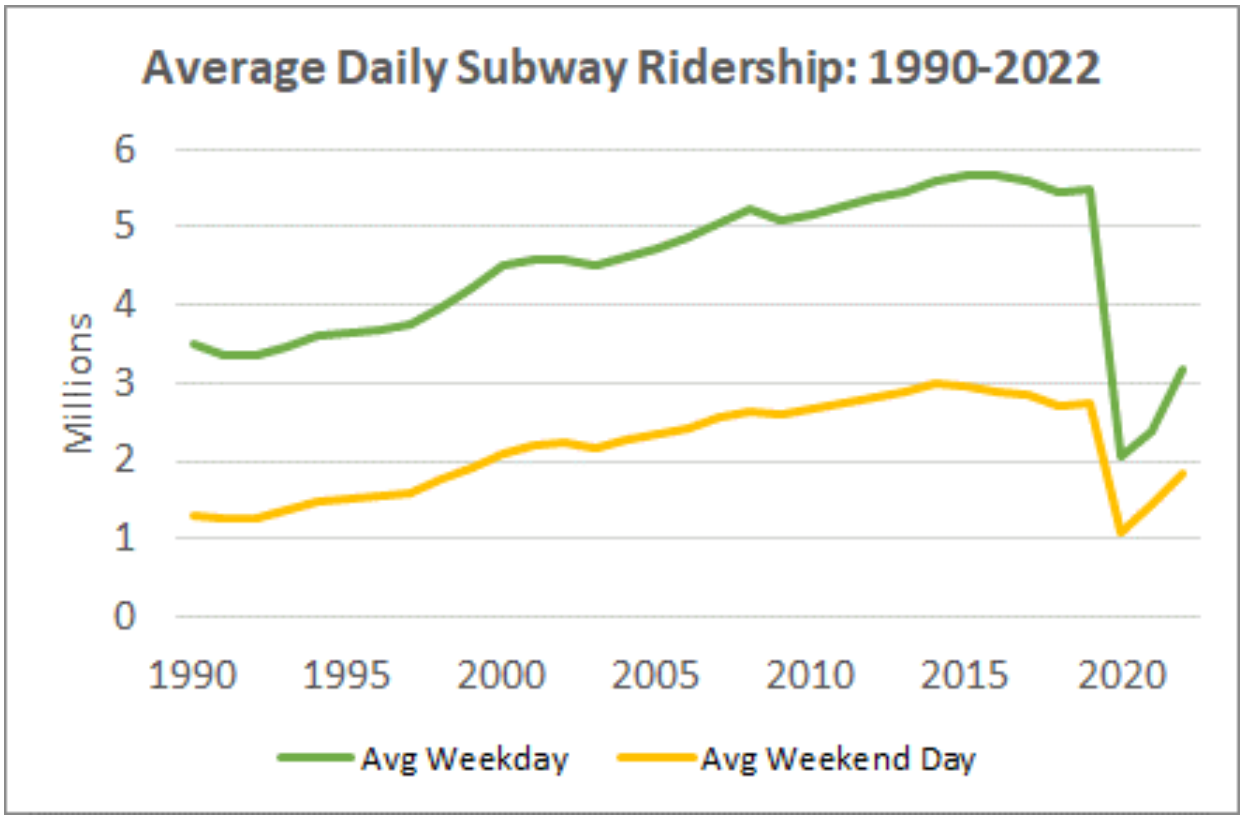

Subway Ridership
The number of paying subway & SIR customers, and estimated number of non-paying customers, on an average weekday
April through June fare evasion data not yet available
Paid
Unpaid
Millions
5
4
3
2
1
0
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
2020
2021
2022
2023

Figure 4: Average Daily Subway Ridership – 1990 -2022



Including Staten Island Railway (SIR), the system consists of 26 different services traversing more than 800 miles of track and serving 493 passenger stations across all five NYC boroughs. Service is provided 24 hours a day, seven days a week. The system map below illustrates the extent of service across the different lines and stations within the boroughs.

Figure 5: New York City Subway Map

2.2 Major NYCT Capital Assets

Below is an overview of the major physical assets comprising the system for Subways and SIR.

Table 1: Key Department of Subways and SIR Capital Assets

Department of Subways Assets

Department of Subways (DOS) Assets	Quantity
Service Lines	*25*
Passenger Rail Car Fleet	6,463
Work Equipment Rolling Stock	580
Railcar Maintenance Shops	14
Railcar Overhaul Shops	2
Car Washers	8
Passenger Stations	472
Station Elevators	249
Station Escalators	224
Total Track Miles (System)	822
Total Switches	2,653
Signal Interlockings	183
Subway Structure Miles	447
Elevated Structure Miles	168
Open Cut Structure Miles	44
Under River Tubes	14
Fan Plants	201
Pump Rooms	301
Line Structures (Route Miles)	227
Emergency Exits	544
Power Substations	221
CBHs	336
Support Shops & Facilities	31
Rail Yards	24

Staten Island Railroad Assets

Staten Island Railway (SIR) Assets	Quantity
Service Lines	*1*
Passenger Rail Car Fleet	69
Work Equipment Rolling Stock	14
Car Maintenance Support Shops	3
Passenger Stations	21
Mainline Track Miles	28.6
Total Switches	92
Line Structures (Route Miles)	14.3
Power Substations	5

The oldest underground portion of the subway system opened in 1904, as the Interborough Rapid Transit Company (IRT); some elevated and surface line segments follow alignments from the late 19th century. Additional lines were built by Brooklyn Manhattan Transit (BMT) and NYC government as the Independent Subway (IND). Today, the NYC Subway is operated by New York City Transit (NYCT), a subsidiary agency of the Metropolitan Transportation Authority (MTA) which also operates Staten Island Railway (SIR) and NYC Bus. NYCT employs a workforce of more than 47,000 and has an annual operating budget of approximately $10.9 billion, most of which supports subway operations, maintenance, and administration.

NYCT is allocated $34 billion in the MTA 2020-2024 Capital Program, which is used to rehabilitate, replace, and upgrade its assets and infrastructure. The MTA recently completed its 2025-2044 Twenty- Year Needs Assessment of the system which is used to prioritize the projects recommended for the upcoming 2025-2029 Capital Program.

New York City Transit's revenue car fleet includes 6,532 cars – with 6,484 operating on the NYC Subway and 69 operating on the Staten Island Railway (SIR). Based on the physical configuration of subway infrastructure, NYC Subway service is divided into two divisions: Subdivision A, which originated as the IRT and includes the numbered routes including the 42nd Street Shuttle, and Subdivision B, which combines lines originated from the BMT and IND and includes the lettered routes along with the Rockaway Park and Franklin Avenue Shuttles.

Physical infrastructure on Subdivision A is narrower than in Subdivision B, with tighter turning radiuses. Accordingly, Subdivision A cars are shorter and narrower (51'4" in length and 8'9" in width) than those on Subdivision B (60'6" or 75' in length and 10' in width). Cars operating on Staten Island Railway have the dimensions of the cars operating on Subdivision B.

Table 2: Subdivision A Fleet Overview

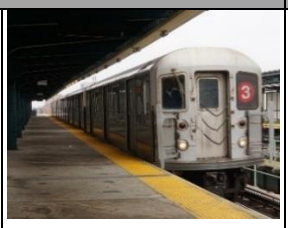
NEW YORK CITY TRANSIT SUBDIVISION A FLEET							
Car Class		# of Cars	Manufacturer	Configuration	Car Length	Placed in Service	Lines Served
R62		315	Kawasaki	5-Car Units	51'-4"	1984 to 1985	1 3
R62A		824	Bombardier	Singles 3-Car Units 5-Car Units	51'-4"	1985 to 1987	1 6 S
R142		1030	Bombardier	5-Car Units	51'-4"	2000 to 2003	2 4 5
R142A		140 80	Kawasaki	5-Car Units	51'-4"	2000 to 2004	4
R188 Conv R188 New		380 126	Kawasaki	5-Car Units 6-Car Units	51'-4"	2000 to 2002 2014 to 2016	7

Table 3: Subdivision B Fleet Overview

NEW YORK CITY TRANSIT SUBDIVISION B FLEET							
Car Class		# of Cars	Manufacturer	Configuration	Car Length	Placed in Service	Lines Served
R46		752	Pullman Std.	4-Car Units	75’	1975 to 1977	A C N W Q SR
R68		425	WEAM	4-Car Units Single Units	75’	1986 to 1988	B D N W SF
R68A		200	Kawasaki	4-Car Units	75’	1988 to 1989	B D N
R143		212	Kawasaki	4-Car Units	60’-6”	2002 to 2003	L
R160A		1002	ALSKAW (Alstom)	4-Car Units 5-Car Units	60’-6”	2005 to 2010	E F M G L J Z R
R160B1		400	ALSKAW (Alstom w/ Kawasaki Propulsion)	5- Car Units			
R160B2		260	ALSKAW (Kawasaki w/ Siemens Propulsion)	5- Car Units			

R179		318	Bombardier	4-Car Units 5-Car Units		2018 to 2019	A C J Z
R211A		20	Kawasaki	5-Car Units	60”-6’	2023	A

Table 4: Staten Island Railway Fleet Overview

Staten Island Railway Fleet							
Car Class		# of Cars	Manufacturer	Configuration	Car Length	Placed in Service	Lines Served
R44		62	St. Louis	Single Units	75’	1971 to 1973	SIR
R211S		5	Kawasaki	5 car Units	60”-6’	2023	SIR

2.3 New York City Transit Routes and Car Lengths by Route

A - Division (IRT)

- 1 Broadway – Seventh Avenue Local
- 2 Broadway – Seventh Avenue Express / White Plains Road Local
- 3 Broadway – Seventh Avenue Express / Lenox Avenue Local
- 4 Lexington Avenue Express / Jerome Avenue Local
- 5 Lexington Avenue Express / White Plains Road Express – Dyre Avenue Local
- 6 Lexington Avenue Local / Pelham Bay Park Local and Express
- 7 Times Square – Flushing Local and Express
- S 42nd Street Shuttle

B – Division (IND/BMT)

- A Washington Heights / Eighth Avenue – Fulton Express
- B Concourse – Central Park West Local – Sixth Avenue – Brighton Express
- C Washington Heights – Eighth Avenue – Fulton Street Local
- D Concourse – Central Park West – Sixth Avenue – West End Express
- E Queens Boulevard Express – Eighth Avenue Local
- F Queens Boulevard Express – Sixth Avenue – Culver Local
- G Brooklyn – Queens Crosstown Local
- J Jamaica – Nassau Street Local and Skip-Stop Express
- L 14th Street – Canarsie Local
- M Myrtle Avenue – Sixth Avenue – Queens Boulevard Local
- N Astoria Local – Broadway Local – Sea Beach Express
- Q Second Avenue – Broadway Express – Brighton Local
- R Queens Boulevard Local – Broadway – Fourth Avenue Local
- SR Rockaway Park – Broad Channel Shuttle
- SF Franklin Avenue Shuttle
- W Astoria – Broadway Local
- Z Jamaica – Nassau Street Skip-Stop Express (rush hours only)

Most subway services operate with either 8-car or 10-car train consists. Exceptions to this are the 11-car Flushing Line 7 service, the 5-car Crosstown Line G service, and the 4-car SIR service, as well as the three full-time S shuttle services, late-night 5 shuttle, late-night Lefferts Blvd A shuttle, and the weekend M shuttle.

Note with the replacement of the SIR fleet to the new R211S cars, the SIR will become a 5-car configuration.

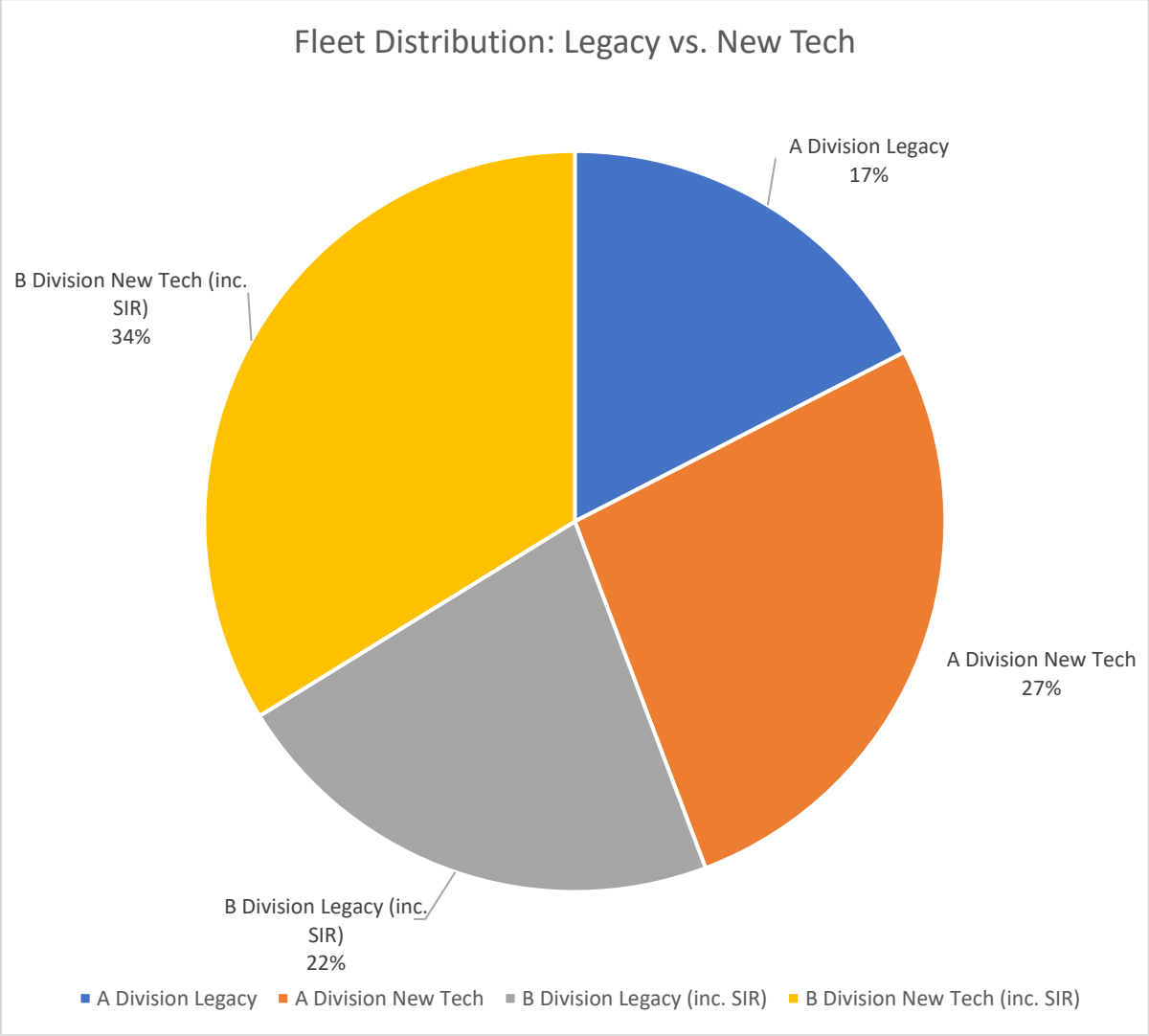
Trains typically consist of two linked operating units, each comprised of either 4-car or 5-car consists (the Flushing Line includes 6-car and 5-car consists). The two end cars of each operating unit are known as “A” cars and contain train operator cabs. The cars located between these “A” cars are known as “B” cars and do not contain train operator cabs.

2.4 New Technology Fleets vs Legacy Fleets

CBTC is the current signaling system on the L and 7 Lines. CBTC is being installed on the Queens Boulevard Line, Culver Line, 8th Avenue Line and Crosstown Line. It is anticipated that CBTC contracts for the Fulton and 6th Avenue Lines will be awarded by the end of the 2020-2024 capital program.

As car equipment ages and needs replacement, the Department of Subways is purchasing fleets that can accommodate the expansion of CBTC signaling. Currently the R46 and the R44S (SIR) fleet are being replaced with the CBTC-ready R211 fleet. The remaining non-new technology fleets, the R62/R62A and R68/R68A, will be the last to be replaced, and design for their replacement fleets is scheduled during the current 2020-2024 program and purchase will occur during the 2025-2029 Capital Programs. The R211S fleet for SIR will not be CBTC-equipped as the SIR utilizes a different signaling system.

Figure 6: Fleet Distribution- Legacy vs New Tech



In addition to being compatible with an upgraded signaling system, new technology cars have AC propulsion systems, rooftop HVAC systems, automatic passenger signage and automated announcements for improved customer communication.

The table below describes the subsystems and components common among all new technology cars.

Table 5: New Technology Cars: Subsystems & Component

NEW TECHNOLOGY CARS: SUBSYSTEMS & COMPONENTS	
Coupler & Drawbar	Train & Car Control
- Mechanical Coupler	- Trainline Control & Networks
- Electric Portion	- Monitoring & Diagnostics
- Drawbar / Link Bar	- Event Recorder
Friction Brake	HVAC
- Air Supply Unit	- Compressor
- Brake Control Unit	- Inverter
- Tread Brake Unit	- HVAC Unit
- Trip Valve	- Floor Heating
Propulsion	Carbody
Inverter/Controller	- Shell
Traction Motor	- Lighting
Gear Unit	- Floor Covering
Master Controller	- Sub Flooring
Auxiliary Power Electric	Communications
LVPS / Converter	- Communications
Battery	- Electronic Signs
Trucks	Doors
- Fabricated Truck Frame	- Door Operators & Controls
- Current Collector	
- Wheels	
- Axles	
- Journal Bearings	

CHAPTER 3 SERVICE PLANNING

3.1 Agency Goals & Requirements

3.1.1 Service / Loading Guidelines

NYC Transit subway service guidelines are used to develop and maintain a comprehensive, cost-efficient transit service that meets the needs of those who live, work, and pass through New York City. These guidelines provide a structure for consistent and fair evaluation of existing and proposed services by determining when, where, and how frequently service should be offered. Moreover, in this Plan's context, loading and peak service requirements are foundations for determining the necessary railcar fleet size and composition.

The Rapid Transit Service Design and Loading Guidelines were adopted by the MTA Board in 1988 and revised in 1991 and 2010. They are intended to address the following questions:

What type of service should be provided?

Route Design Guidelines determine the proper application of different routing patterns (through local, express/local, skip-stop, shuttle) for subway lines.

How frequently should service be provided?

Frequency Guidelines establish the minimum service frequencies (known as "policy headways") for subway service, while **Loading Guidelines** determine how much subway service should be provided, based on the number of customers on a train at the route's busiest point (the "peak load point"). The Guidelines allow for flexibility in their application based on capacity of the subway infrastructure as well as construction and maintenance.

What is the methodology to change service?

Service Change Guidelines specify the process for making major and minor changes to bus and subway service, such as changes in routing, stop patterns, and/or hours of service.

Note that Staten Island Railway does not have specific loading guidelines; instead, train schedules are written to align with the Staten Island Ferry schedule.

3.1.2 Subway Route Design

The New York City subway system is complex, with an extensive network of two-, three- and four-track line segments featuring local and express stations and numerous track connections between lines (interlining). This complexity provides many possibilities for subway routing. The rail service design process analyzes and incorporates ridership patterns and origin-destination patterns, as well as operational feasibility, resource availability, and schedule consistency.

NYC Transit operates four subway service patterns to maximize efficiency and meet customer demand:

Through local service:

Trains operate to/from Manhattan and/or Downtown Brooklyn, stopping at all stations (e.g., the L route).

Express/local service:

Trains operate on parallel tracks, with local trains making all stops and express trains making express stops only. Express/local service can operate in several configurations:

On four-track lines, express service can operate in both directions (e.g., EFMR service on the Queens Boulevard line).

On three-track lines, express service operates in one direction only (e.g., 7 express service on the Flushing line in Queens), generally with the direction of express service changing to match peak passenger flows (e.g., to Manhattan in the morning and from Manhattan in the evening).

A variation of the express/local pattern is a zone system (e.g., 6 express service on the Pelham line in the Bronx), where a subway line is divided into "outer" and "inner" zones. Zone express trains stop at all stations in the outer zone, and then skip all or most stations in the inner zone. Local trains make all stops in the inner zone and may originate at the boundary station between the zones (e.g., Parkchester).

Skip-stop service:

Trains with two separate designations operate on the same track in two stopping patterns. Some stations are served by one of the trains, some stations are served by the other train, and some stations are served by both trains (e.g., JZ service).

Shuttle service:

Trains operate on a branch line and offer one of more transfer points to a through service (e.g., overnight 5 shuttle trains terminate at East 180th Street, where customers can transfer to the 2 train for service to Manhattan).

3.1.3 Subway Frequency Guidelines

Schedule guidelines establish the minimum service frequencies (also known as "policy headways") for subway service if feasible, averaged over one hour. This headway is intended to maintain basic mobility throughout NYCT's service area. The policy headways for subway service vary by time of day and by day of week. In many cases, however, routes need to operate at shorter intervals (mor frequently) than the "policy headways" to accommodate higher ridership levels. In these cases, Loading Guidelines match service to the number of riders using a particular route at a given time.

Table 6: Minimum Service Frequencies

MINIMUM SERVICE FREQUENCIES		
Time Period	Minimum Frequency (tph)	Maximum Headway (mins)
Rush Hour	6	10
Weekday Midday	6	10
Saturday Midday	6	10
Weekday Evening	5	12
Saturday Evening	5	12
Sunday (all day)	5	12
Late Night	3	20

On the subway system, there is an exception to the minimum service frequencies. If through service on a subway line operates on more than one branch, the service frequency on each branch, or on shuttle trains connecting to a branch, may be less than the minimum service frequency (e.g., the Lefferts Blvd and Rockaways branches of the A route). This may occur in cases where the track or platform configuration does not permit a timed transfer between a through route and a shuttle, or it may be based on operating cost considerations, the proportion of ridership on each branch, or the length of each branch.

3.1.4 Subway Loading Guidelines

Loading guidelines supplement the minimum policy frequencies to determine the appropriate level of subway service based on the peak load point – the greatest number of customers riding at one time along a route. The number of customers can vary by the frequency of service, time of day/day of week, train size or type, and route type. NYCT loading guidelines reflect this variation.

There are several important characteristics of loading guidelines:

Policy headways apply when ridership is below the threshold level that would trigger applying the loading guidelines; loading guidelines apply when ridership is at or higher than that threshold level. The threshold ridership level for the application of loading guidelines instead of schedule guidelines vary by time of day and day of week; see Section 3.1.2 above for details.

Loading guidelines are based on the peak load point on a subway route in the peak direction. The number of customers at other locations along the route, and in the reverse direction, is lower than at the maximum load point.

Loading guidelines are an average for each time period. For example, subway loading guidelines call for 125% of a seated load on routes during off-peak hours, where feasible. This guideline does not guarantee that no subway train or individual subway cars will carry more than 125% of a seated load; it seeks to ensure that, on average, trains will carry 125% of a seated load of customers during off-peak hours, if feasible.

The distribution of customers on a train is almost never even; some cars will be more crowded than others. Loading in some cars may be above the guideline, even if the overall train load is within the guideline. Loading guidelines are designed for optimal operations. Delays in service may cause individual train cars or entire train lengths to be overcrowded.

Loading guidelines also have a sliding scale during peak periods, with fewer customers per train considered acceptable on routes with less frequent service. This encourages ridership on less heavily traveled routes by scheduling more frequent service than demand would otherwise warrant based on maximum guideline loads and making transit a more attractive option.

Operational feasibility – including (but not limited to) the availability of subway cars, the capacity of the signal system, available traction power, and/or capacity constraints due to maintenance and construction work on the right-of-way that requires slower speeds to ensure worker protection – may require that fewer trains operate than would otherwise be recommended by guidelines.

Subway loading guidelines differ for the three sizes of subway cars used by NYC Transit: Subdivision A 51-foot cars (car classes R62, R62A, R142, R142A, and R188), Subdivision B 60.5-foot cars (car classes R143, R160A, R160B, R179, and R211), and Subdivision B 75-foot cars (car classes R46, R68, and R68A).

The following section outlines in greater detail the loading guidelines for subway service for peak, off-peak and late-night service.

Peak Period:

All subway service is scheduled to provide for standees during peak periods at the peak load point. When service operates more frequently, the guidelines allow more customers per car. The maximum capacity for each car size is based on a standing space of three square-feet per standing customer. Maximum train frequency may be constrained by track capacity or other constraints, leading to loads above guideline levels.

Off-Peak Periods:

All subway service is scheduled to 125 percent of a seated load during off-peak periods, if feasible. During overnight periods, service frequency will generally be governed by the schedule guideline's minimum frequency of 20 minutes. A uniform 20-minute service frequency enables NYC Transit to schedule train-to-train connections for customers while also reducing train frequencies to allow for critical maintenance work to be undertaken under traffic.

The following table provides the detailed subway loading guidelines for Subdivision A's 51-foot cars and Subdivision B's 60.5-foot and 75-foot cars.

Table 7: Loading Guidelines

LOADING GUIDELINES (PASSENGERS PER CAR)			
	Subdivision A (51' car)	Subdivision B (60.5' car)	Subdivision B (75' car)
Peak Periods	90-110	115-145	140-175
Off-Peak Periods	48-54	53-54	88-93

3.1.5 Service Change Guidelines

NYC Transit guidelines specify the procedure for changing any of three basic characteristics of train service: frequency (how often a service operates), span (when a service operates), and routing (where a service operates). These guidelines outline the process for obtaining official approval for a service change. This process begins after NYC Transit staff analyzes and recommends a service change based on community input, demographic factors, ridership, performance data, and service guidelines.

The service change guidelines specify criteria for major and minor changes.

Minor Changes (aggregated over a 12-month period) are defined as those resulting in:

- Less than 25% change in daily revenue miles (frequency)
- Less than one hour service span reduction or any same-day service span increase
- Less than 25% change in route miles (routing)

Major Changes (aggregated over a 12-month period) are defined as those resulting in:

- 25% or greater change in daily revenue miles (frequency)
- One hour or more reduction in service span
- 25% or greater change in route miles (routing)

Major changes require a public hearing and Board approval.

3.2 Current Levels of Service

Current levels of service are governed by NYCT service and loading guidelines, as outlined in section 3.1. While frequency guidelines establish NYCT's maximum headways, service levels at most times of day are determined based on agency loading guidelines. Because train requirements are highest during peak periods, they are dictated by peak hour ridership and scheduled headways. As such, this section outlines: (1) current ridership and volume/capacity ratios, (2) current peak headways, and (3) current train requirements for peak service and spares.

3.2.1 Current Ridership & Loading

As noted in previous sections, prior to the Covid-19 pandemic, subway ridership had been steadily increasing over the prior thirty years, peaking in 2016 with 1.76 billion annual riders and then declining to slightly below that level, to 1.7 billion, by 2019. Growth had been particularly strong outside peak periods, including weekends, mid-days, and the "shoulder" periods before and after the traditional AM and PM peak hours. Ridership during 2020 decreased by over 60% from the previous year due to the Covid-19 pandemic, and as of mid-2023, has recovered to approximately 68% of 2019 levels on average, with stronger recovery levels on Tuesdays-Thursdays, and during off peak periods (particularly weekends). Due to continued uncertainty about how post-pandemic travel patterns will stabilize in the short term, peak period service levels have remained largely

unchanged since 2019. However, as of mid-2023, NYCT has begun to increase off-peak service on some lines.

Train requirements are dictated by peak service levels, within the peak hour as well as during the "shoulder" periods before and after the peak hour, as discussed further in Section 3.2.3. Loading guidelines are generally assessed at each line's peak load point in each direction. The tables below indicate the peak load point by subway service, as well as estimated peak hour ridership, and the volume/capacity (V/C) ratio at that location for 2019. V/C ratios exceeding 1.00 indicates that in 2019 the line exceeded NYCT loading guidelines at its peak load point, averaged over all trains in the peak hour. As of mid-2023, peak period ridership continues to recover from the Covid-19 pandemic and is over two-thirds of pre-Covid levels on average. Peak period service levels (peak TPH) remain unchanged from 2019 levels.

Table 8: Pre-covid Peak Ridership & Loadings – Subdivision A

PRE-COVID PEAK RIDERSHIP & LOADING: SUBDIVISION A					
Line	Dir	Peak Load Point	Pre-Covid Est. Peak Hour Volume	Pre-Covid Average Peak TPH	Pre-Covid Actual V/C
2	NB	Nevins St	7,356	9.9	0.68
3	NB	Nevins St	5,750	8.0	0.65
4	NB	14 St-Union Sq	12,344	12.4	0.91
5	NB	14 St-Union Sq	10,855	11.3	0.87
6	NB	14 St-Union Sq	14,909	19.7	0.69
1	SB	103 St	15,794	18.0	0.80
2	SB	72 St	12,928	11.3	1.04
3	SB	72 St	12,307	11.7	0.96
4	SB	86 St	13,813	12.8	0.98
5	SB	86 St	13,478	12.3	0.99
6	SB	3 Av-138 St	19,305	18.5	0.95
7	SB	40 St	13,783	14.8	0.77
7	SB	Woodside-61 St	14,636	12.8	0.95
S	SB	Times Square-42 St	6,269	32.7	0.58

Table 9: Pre-covid Peak Ridership & Loading – Subdivision B

PRE-COVID PEAK RIDERSHIP & LOADING: SUBDIVISION B					
Line	Dir	Peak Load Point	Pre-Covid Est. Peak Hour Volume	Pre-Covid Average Peak TPH	Pre-Covid Actual V/C
A	NB	Hoyt – Schermerhorn Sts	16,867	16.4	0.74
B	NB	7 Av	10,870	9.7	0.80
C	NB	Clinton-Washington Avs	6,752	7.9	0.74
D	NB	36 St	10,504	9.5	0.79
F	NB	2 Av	16,172	12.5	0.89
G	NB	Greenpoint Av	5,590	8.8	0.91
L	NB	1 Av	22,941	19.2	1.03
M	NB	Marcy Av	8,506	9.0	0.81
N	NB	36 St	9,976	9.1	0.76
Q	NB	7 Av	12,350	10.0	0.85
R	NB	Union St	8,048	10.3	0.56
A	SB	125 St	12,753	10.7	0.85
B	SB	59 St-Columbus Circle	7,493	7.6	0.70
C	SB	72 St	6,173	7.1	0.75
D	SB	125 St	9,405	8.5	0.76
E	SB	Jackson Hts-Roosevelt Av	21,149	13.1	1.12
F	SB	Jackson Hts-Roosevelt Av	19,555	13.1	1.03
G	SB	Clinton-Washington Avs	4,944	8.6	0.82
J Z	SB	Marcy Av	10,007	12.3	0.70
M	SB	Elmhurst Av	7,677	8.2	0.80
N W	SB	Queensboro Plaza	19,343	13.9	0.96
Q	SB	72 St	14,173	10.7	0.91
R	SB	Queens Plaza	7,911	10.0	0.57

Note: corridors with fewer than 15 tph are held to a stricter guideline; for example, northbound M trains leaving Marcy Av are less crowded than more frequent trains with V/Cs under 1.0

3.2.2 Current Scheduled Headways

The number of trains required to be in the railcar fleet is driven by the peak train requirements. The dominant factor for this is the amount of service scheduled during peak periods (the length of the peak period varies by line). These schedules take the following factors into account:

- Guidelines
- Ridership levels, which determine which guidelines apply
- Running times, which can differ by time of day
- Track capacity, which is based on the signal system, power supplies, and station dwell times and which can differ by line segment and track

- Terminal and interlocking operations, which can differ based on track layout
- Fleet availability
- Train storage requirements and locations
- Service design, including branches and short-turn terminals
- Shared trackage with other subway routes
- Work on the right of way

Currently scheduled peak weekday headways (in minutes) are as follows:

Table 10: Peak Headways – Subdivision A & Subdivision B

PEAK HEADWAYS: SUBDIVISION A			
Line	Direction	AM Rush	PM Rush
1		3.5	4.0
2	(SB)	5.5	6.0
2	(NB)	7.0	6.0
3	(SB)	5.0	8.0
3	(NB)	7.0	5.5
4	(SB)	4.5	5.5
4	(NB)	5.0	5.0
5	(SB)	4.5	7.0
5	(NB)	6.0	4.5
6		3.0	3.5
7		2.0	2.5
S	(42 St.)	3.5	3.0

PEAK HEADWAYS: SUBDIVISION B			
Line	Direction	AM Rush	PM Rush
A	(SB)	6.5	4.0
A	(NB)	4.5	6.5
B	(SB)	9.5	6.5
B	(NB)	6.0	10.0
C	(SB)	10.0	10.0
C	(NB)	8.0	10.0
D	(SB)	7.5	6.0
D	(NB)	6.0	8.5
E	(SB)	4.0	5.0
E	(NB)	5.0	4.0
F	(SB)	4.0	5.0
F	(NB)	5.5	4.5
G		7.0	8.0
J		5.5	7.5
L		3.0	3.5
M	(SB)	7.5	8.0
M	(NB)	6.5	8.0
N	(SB)	4.0	4.0
N	(NB)	4.0	4.0
Q	(SB)	6.5	6.5
Q	(NB)	6.5	6.5
R	(SB)	7.0	6.5
R	(NB)	7.0	7.5
SF	(Franklin)	10.0	10.0
SR	(Rockaway)	16.0	14.5

3.2.3 Current Train Requirements

As noted above, the total number of trains required for any given line is driven by peak train requirements – that is, the number of trains required to provide service during the rush hour period when the most service is scheduled. On many lines, the morning and evening rush hour peak train requirements are the same, but several lines have higher train requirements in the morning, and a small number of lines have higher requirements in the evening.

To determine the number of trains required for service, Operations Planning determines the number of trips needed to maintain loads and/or frequencies within guideline levels, when feasible, and the terminal-to-terminal running times in each direction. Since most subway routes carry peak loads in both directions, the number of trains required is generally based on the roundtrip cycle time for a train, including the end-to-end running times in each direction, as well as the amount of time needed for the train to remain in both terminals to "recover" from delays, to be cleaned, and to change crews and directions. For instance, if, based on ridership and guidelines, a subway line requires 12 trains per hour (an average 5-minute headway) and the roundtrip cycle time is 120 minutes, then, preliminarily, the minimum number of trainsets required for peak service to would be determined by the cycle time divided by the headway – or 120 / 5 = 24 trainsets.

Once a more detailed timetable is laid out, the number of trainsets required for peak service may differ slightly, based on various operational factors, such as how trains are put into and laid up from service, how merges among multiple routes are handled, and whether trainsets can be shared between lines.

Table 11: AM Peak Train Requirements – Subdivision A

AM PEAK TRAIN REQUIREMENTS BY SERVICE: SUBDIVISION A									
	1	2	3	4	5	6	7	S	Total
Trains Required	31	35	25	35	34	37	38	2	237
Cars Required	310	350	250	350	340	370	418	12	2,400

Table 12: AM Peak Train Requirements – Subdivision B

AM PEAK TRAIN REQUIREMENTS BY SERVICE: SUBDIVISION B																
	A	B	C	D	E	F	G	J Z	L	M	N W	Q	R	S^R	S^F	Total
Trains Required	38	25	18	29	26	45	13	20	24	24	33	21	31	3	2	352
60' cars	13	0	9	0	26	45	13	20	24	24	0	0	31	1	0	206
75' cars	25	25	9	29	0	0	0	0	0	0	33	21	0	2	2	146
Cars Required	330	200	144	232	260	450	65	160	192	192	264	168	310	13	4	2,984

3.2.4 Current Spare Requirements

In addition to peak train requirements for service, NYCT plans for a percentage of its cars to be unavailable for service on any given day. This is to accommodate fleet maintenance and improvements, including scheduled inspections, scheduled SMS and unscheduled maintenance, special modifications, and improvement initiatives.

In addition to "unavailable" spare cars, "reserve cars" are cars that are available for service (i.e., not expected to be undergoing maintenance or inspection) but not required. When feasible, NYCT strives to maintain a small number of reserve cars, as these cars provide flexibility for unanticipated decreases in car availability or increases in car requirements. Though car availability fluctuates on a day-to-day basis, the table below indicates typical unavailability based on NYCT's most recent car assignments:

Table 13: Average Spare Car Composition

AVERAGE SPARE CAR COMPOSITION			
	Division A	Division B	Total
SMI	60	80	140
SMS	55	79	134
Modifications	54	60	114
Track Tests	0	24	24
Scheduled – Subtotal	169	243	412
Daily Material Holds	72	88	160
Unscheduled Holds	158	159	317
Main Shop Repairs	79	66	145
Long-Term Holds / Collisions	11	6	17
Unscheduled – Subtotal	320	319	639
Total Unavailable	489	562	1,051
Reserve	10	31	41
Total Spares	499	593	1,092

As indicated in the previous table, scheduled and unscheduled unavailability may be due to:

- **Scheduled Maintenance Inspection (SMI)** – discussed in Section 4, the SMI program requires cars to undergo routine inspection and light maintenance on a periodic cycle
- **Scheduled Maintenance System (SMS)** – discussed in Section 4, the SMS program includes several distinct cycles of heavy maintenance performed in NYCT overhaul shops

- **Modifications** – special campaigns to modify or upgrade car systems or components
- **Track Tests** – annual requalification testing required for all cars with microprocessor-regulated propulsion controllers; track tests may also be scheduled following a major component repair or modification
- **Daily Material Holds** – cars may be held following inspection due to unavailability of replacement parts; parts may be coming from a storeroom, an overhaul facility, or directly from a vendor; cars being held for material are generally released within 2-5 days
- **Unscheduled Holds** – cars may also be held in a maintenance facility because they require unscheduled repairs or inspections exceeding one day; cars may also be held due to five-car unit configurations (teams typically inspect two cars per day)
- **Main (Overhaul) Shop Repairs** – overhaul shops perform repair work which would take more than 4 days to perform in a maintenance facility; railcars are typically held for 5 days for a large component replacement, 1 day for a truck change, and extended periods for structural damage or flood damage (often becoming long-term holds)
- **Long-Term Holds / Collisions** – cars held for longer than 30 days are considered long-term holds; this is usually due to difficult-to-find replacement parts; in addition, cars involved in collisions are held out of service for repairs, internal and external investigation, and extensive engineering evaluation.

As of mid-2023 the spare factors are 20.4% on Subdivision A and 19.8% on Subdivision B. Prior to the introduction of CBTC NYCT typically included 17.5% spares in railcar purchases. The spare factor for CBTC lines was initially increased to 21% because relatively few cars were CBTC-equipped and because reliability was unknown. As newer cars include more subsystems, NYCT has found there are more failures and hence a need for more spares. On the other hand, all future purchases will be CBTC-equipped or CBTC-ready, which will provide increased ability to move cars between yards. Thus, purchases starting with the R211 will assume a 20% spare factor.

3.2.5 Current Car Assignments

Car Assignments are produced by Operations Planning, in consultation with the Divisions of Car Equipment and Service Delivery. They are periodically revised to reflect changes in requirements, availability, and fleet size. OP consults with DCE to determine anticipated car unavailability and ensures that sufficient cars are available to meet peak service requirements.

Cars are assigned to a given service based on a variety of factors, including maintenance requirements, dwell time control, customer information capabilities, and compatibility with constraints imposed by platform lengths, track curvatures, and signal systems. Car classes are not necessarily dedicated to specific lines; however, in CBTC territories, railcars must be compatible and equipped with the appropriate CBTC equipment. (NYCT currently operates three different CBTC systems, on the Canarsie L, Flushing 7, and Queens Blvd EFMR lines.)

Table 14: Subdivision A AM Peak Car Assignments

Subdivision A AM Peak Car Assignments (as of December 2022)	R62	R62A	R142	R142A	R188	Total
1. TOTAL VS. AVAILABLE FLEET						
Total Fleet	315	824	1025	220	506	2890
Unavailable Cars	55	132	135	50	143	515
Available Cars (Total Fleet – Unavailable Cars)	260	692	890	170	363	2375
2. CARS REQUIRED FOR SERVICE						
1		310				310
2			350			350
3	250					250
4			180	170		350
5			340			340
6		370				370
7					418	418
S		12				12
Total Cars Required for Service	250	692	870	170	418	2400
3A. RESERVE CARS						
Reserve (Cars Available – Total Cars Req. for Service)	10	0	20	0	0	30
Reserve % (Reserve / Total Cars Req. for Service)	4.0%	0.0%	2.3%	0.0%	0.0%	1.3%
3B. FEDERAL SPARES						
Federal Spares (Total Fleet – Total Cars Req. for Service)	65	132	155	50	88	490
Spare % (Federal Spares / Total Cars Req. for Service)	26.0%	19.1%	17.8%	29.4%	21.1%	20.4%

Table 15: Subdivision B – AM Peak Car Requirements

Subdivision B AM Peak Car Assignments (as of December 2022)	R46	R68	R68A	R143	R160	R179	R211	Total
1. TOTAL VS. AVAILABLE FLEET								
Total Fleet	752	425	200	212	1662	318	20	3589
Unavailable Cars	114	56	32	36	254	57	0	549
Available Cars (Total Fleet-Unavailable Cars)	638	369	168	176	1408	261	20	3040
2. CARS REQUIRED FOR SERVICE								
A	200					110	20	330
B		48	152					200
C	72					72		144
D		232						232
E					260			260
F					450			450
G					65			65
J Z					88	72		160
L				176	16			192
M					192			192
N W	168	80	16					264
Q	168							168
R					310			310
SR	8					5		13
SF		4						4
Total Cars Required for Service	616	364	168	176	1381	259	20	2,984

3A. RESERVE CARS								
Reserve (Cars Available – Total Cars Req. for Service)	22	5	0	0	27	2	0	56
Reserve % (Reserve / Total Cars Req. for Service)	3.6%	1.4%	0.0%	0.0%	2.0%	0.8%	0.0%	1.9%
3B. RESERVE CARS								
Federal Spares (Total Fleet – Total Cars Req. for Service)	136	61	32	36	281	59	0	605
Spare % (Federal Spares / Total Cars Req. for Service)	22.1%	16.8%	19.0%	20.5%	20.3%	22.8%	0.0%	20.3%

3.2.6 Current Capacity Constraints

As noted in previous sections, NYCT continues to operate peak period service at pre-pandemic levels as ridership recovers. As of mid-2023, peak period ridership is over two-thirds of pre-pandemic levels and peak period service operates with loads within guideline on average. Some subway lines have constraints on track capacity that limit increasing rush hour service, even where future ridership demand may warrant operating more trains.

Line Haul Capacity Constraints: Should ridership increase to levels higher than recorded in 2019, line haul capacity constraints, due to a combination of signal design and station dwell times, will again become a concern on some of the busiest line segments in the system. Lines currently operating at or close to track capacity include:

- *Lexington Avenue Line express* 4 5
- *7th Av Line express* 2 3
- *Myrtle Avenue line* M

Long term as CBTC and, if necessary, associated traction power upgrades are rolled out across the network, NYCT anticipates capacity increases of approximately 10-20% on these corridors. CBTC on the Flushing Line was completed in 2019 allowing for an increase in service from 27 tph to 29 tph. CBTC implementation is underway on the Queens Boulevard line and, in its final configuration, is anticipated to increase capacity on the E and F routes. CBTC is under construction on additional portions of the E and F lines, as well as on portions of the A and C lines, the local lines of the Queens Blvd Line M, R, and the entire G line.

3.3 Projected Future Levels of Service

3.3.1 Methodology

Long-term ridership forecasts are based on NYCT's in-house Travel Demand Model (TDM). The model begins with a computerized representation of the NYC transit network and divides the city into Travel Analysis Zones. A "trip table" derived from a combination of AFC data, census data, and surveys, estimates the number of people using transit to travel between every combination of origin zones and destinations zones. An "assignment" process is then used to estimate the route choice of each rider between each origin and destination zone. That route choice is based on the best combination of in-vehicle time, waiting time, walking time, the number of transfers, and relative crowding. The model is validated against observed volumes at each route's "peak load points", to establish baseline conditions.

The trip table is then updated to future year conditions using demographic forecasts prepared by the New York Metropolitan Transportation Council (NYMTC) and the NYC Department of City Planning. A new assignment is run, incorporating funded changes to the transit network. The major capital projects included in the 2045 model were Phase 2 of Second Avenue Subway, LIRR Grand Central Madison, which had not yet been completed when these forecasts were developed, MNR Penn Station Access, and CBTC on the Queens Boulevard line.

Aside from additional cars required for new initiatives such as the Second Avenue Subway Phase 2 (SAS2), NYCT bases fleet growth requirements for upcoming car purchases on model-based projections of ridership growth rates applied to recent ridership data, applying the Loading Guidelines to guide estimates of additional peak train trips required, where track capacity permits. NYCT is currently working on projections for 2045.

3.3.2 Projected Ridership & Service Levels

Given the uncertainty around long term population and ridership patterns post-Covid, NYCT developed fleet projections using a ridership growth range, consistent with projections developed for the MTA by McKinsey & Co. for post-pandemic Mid and High range recovery projections. Previously developed projections of long-term growth rates were applied for the years from 2035 to 2045. Note that the McKinsey projections were developed in the context of fare revenue and thus were based on aggregate quarterly ridership.

The ridership projected below represents the equivalent scenarios for peak hour ridership for midweek days (Tuesday to Thursday), when ridership is projected to continue to be highest. While there has been much speculation about high recovery rates in off-peak hours, as of mid-2023 ridership in the AM peak hour on midweek days is at about 68% of pre-Covid levels, in line with the 68% total weekday recovery rate.

Where projected 2045 ridership at the peak load point approaches or exceeds the Loading Guidelines (applied as a Volume to Capacity, or V/C, ratio of 0.95 or higher on lines where the maximum Guideline applies, or a V/C ratio of 1.0 or higher on lines where the frequency Guideline applies), Operations Planning recommends enough additional trains to satisfy the ridership demand, unless service is constrained by signal capacity. On lines where Communications-Based Train Control (CBTC) is scheduled to be implemented by 2045, we incorporate an estimated

maximum track capacity gain of approximately 10% to 20% per track associated with CBTC, assuming the availability of sufficient traction power. Since train requirements on most lines are highest in the morning peak period, this analysis is based on the morning peak hour along with the half-hour shoulders before and after the peak hour.

Table 16: Projected Peak Hour Ridership & Loading – Subdivision A [High Recovery Scenario]

PROJECTED PEAK HOUR RIDERSHIP & LOADING: SUBDIVISION A High Recovery Scenario						
Line	Dir	Peak Load Point	Current Peak Hour TPH	2045 Est. Peak Hour Volume	2045 Peak Hour TPH	2045 Projected V/C
1	SB	103 St	18	16,556	18	0.84
2	NB	Atlantic Av	11	7,745	11	0.64
2	SB	72 St	12	13,582	13	0.95
3	NB	Atlantic Av	10	6,030	10	0.55
3	SB	72 St	12	12,445	12	0.94
4	NB	14 St – Union Sq	13	12,870	13	0.90
4	SB	Grand Central – 42 St	14	13,847	14	0.90
5	NB	14 St – Union Sq	13	11,048	13	0.77
5	SB	Grand Central – 42 St	14	13,602	14	0.88
6	SB	68 St – Hunter College	20	20,747	20	0.94
7	SB	40 St	15	13,383	15	0.74
7	SB	Woodside-61 St (Express)	15	15,098	15	0.83

Table 17: Projected Peak Hour Ridership & Loading – Subdivision A [Mid-Recovery Scenario]

PROJECTED PEAK HOUR RIDERSHIP & LOADING: SUBDIVISION A Mid Recovery Scenario						
Line	Dir	Peak Load Point	Current Peak Hour TPH	2045 Est. Peak Hour Volume	2045 Peak Hour TPH	2045 Projected V/C
1	SB	103 St	18	14,630	18	0.74
2	NB	Atlantic Av	11	6,844	11	0.57
2	SB	72 St	12	12,002	12	0.91
3	NB	Atlantic Av	10	5,329	10	0.48
3	SB	72 St	12	10,998	12	0.83
4	NB	14 St – Union Sq	13	11,373	13	0.80
4	SB	Grand Central – 42 St	14	12,236	14	0.79
5	NB	14 St – Union Sq	13	9,763	13	0.68
5	SB	Grand Central – 42 St	14	12,019	14	0.78
6	SB	68 St – Hunter College	20	18,333	20	0.83
7	SB	40 St	15	11,826	15	0.65
7	SB	Woodside-61 St (Express)	15	13,341	15	0.74

For Subdivision A, the 2045 peak ridership estimates project no need for additional service in the Mid-range recovery scenario. In the High-range scenario, the only projected increases are on the SB 2 and on the 7 express in the late shoulder period, and the additional 7 express train required to be needed in the late shoulder can be provided by recycling a peak-hour train.

Table 18: Projected Peak Hour Ridership & Loading – Subdivision B [High Recovery Scenario]

PROJECTED PEAK HOUR RIDERSHIP & LOADING: SUBDIVISION B High Recovery Scenario						
Line	Dir	Peak Load Point	Current Peak Hour TPH	2045 Est. Peak Hour Volume	2045 Peak Hour TPH	2045 Projected V/C
A	NB	Nostrand Av	17	19,399	17	0.79
A	SB	125 St	11	13,194	11	0.83
B	NB	7 Av	10	11,888	10	0.82
B	SB	72 St	7	7,410	7	0.73
C	NB	Hoyt – Schermerhorn Sts	7	8,141	9	0.98
C	SB	72 St	8	7,002	8	0.75
D	NB	36 St	10	11,109	10	0.77
D	SB	125 St	9	9,725	9	0.75
E	SB	Court Sq	15	24,054	18	0.92
F	NB	2 Av	13	17,033	13	0.97
F	SB	Roosevelt Island	15	19,040	15	0.88
G	NB	Greenpoint Av	9	6,234	11	0.99
G	SB	Clinton – Washington Avs	9	5,226	10	0.91
J Z	SB	Marcy Av	12	11,191	12	0.86
L	NB	1 Av	20	25,558	24	0.92
M	NB	Marcy Av	10	8,988	10	0.90
M	SB	Court Sq	9	7,540	9	0.72
N	NB	36 St	9	10,550	10	0.73
N W	SB	Queensboro Plaza	15	19,056	15	0.88
Q	NB	7 Av	10	13,506	10	0.93
Q	SB	72 St	13	24,698	19	0.96
R	NB	DeKalb Av	10	8,562	10	0.68
R	SB	Queens Plaza	9	7,340	9	0.56

Table 19: Projected Peak Hour Ridership & Loading – Subdivision B [Mid-Recovery Scenario]

PROJECTED PEAK HOUR RIDERSHIP & LOADING: SUBDIVISION B Mid Recovery Scenario						
Line	Dir	Peak Load Point	Current Peak Hour TPH	2045 Est. Peak Hour Volume	2045 Peak Hour TPH	2045 Projected V/C
A	NB	Nostrand Av	17	17,142	17	0.70
A	SB	125 St	11	11,659	11	0.73
B	NB	7 Av	10	10,505	10	0.72
B	SB	72 St	7	6,548	7	0.65
C	NB	Hoyt – Schermerhorn Sts	7	7,194	8	0.98
C	SB	72 St	8	6,187	8	0.67
D	NB	36 St	10	9,817	10	0.68
D	SB	125 St	9	8,594	9	0.66
E	SB	Court Sq	15	21,256	16	0.92
F	NB	2 Av	13	15,052	13	0.86
F	SB	Roosevelt Island	15	16,825	15	0.77
G	NB	Greenpoint Av	9	5,509	10	0.96
G	SB	Clinton – Washington Avs	9	4,618	10	0.80
J Z	SB	Marcy Av	12	9,889	12	0.76
L	NB	1 Av	20	22,585	21	0.93
M	NB	Marcy Av	10	7,943	10	0.79
M	SB	Court Sq	9	6,663	9	0.64
N	NB	36 St	9	9,323	10	0.64
N W	SB	Queensboro Plaza	15	16,839	15	0.77
Q	NB	7 Av	10	11,935	10	0.82
Q	SB	72 St	13	21,825	17	0.95
R	NB	DeKalb Av	10	7,566	10	0.61
R	SB	Queens Plaza	9	6,487	9	0.50

Tables 18 and 19 above summarize the projected peak hour ridership and scheduled service for the B-Division. All growth in southbound Q service is considered to be part of the SAS2 requirement. Combining the above with the additional forecasted trains needed for the shoulder periods, the non-SAS2 growth totals fourteen additional trains in the High scenario: 1 for the A, 4 for the C, 3 for the E, 2 for the G, and 4 for the L; and four total additional trains (1 for the C, 1 for the E, 1 for the G and 1 for the L) in the Mid scenario. The increase on the L assumes additional traction power upgrades in the High scenario. For a discussion of train requirements for Phase II of the Second Avenue Subway, see Section 3.4.1 System Expansion Proposals.

3.3.3 Projected Car Requirements for Service

Projected car requirements show no increase in Subdivision A cars due to running time optimizations made in 2022. Subdivision B shows a projected increase from 139 for the Mid scenario to 242 in the High scenario. This increase in Subdivision B cars is currently accounted for under the R211 contract including Options 1 and 2 without the need for any additional car purchases.

Table 20: Projected Change in Service Car Requirements

2045 Projected Change in Service Car Requirements Summary	**High**	**Mid**
A Division:		
A Division total	**-20**	**-30**
B Division:		
SAS Phase 2 (in 5-car units)	140	120
Non-SAS growth (in 5-car units)	50	15
Non-SAS growth (in 4-car units)	52	4
Total non-SAS growth	102	19
B Division total	**242**	**139**

This methodology yields a need for an additional 0-1 trains for service on the A Division, plus an additional 16-23 trains for service on the B Division. These needs exclude spare requirements, which are outlined in the next section. These projections also assume some changes in line configuration, with the 42 St shuttle changing from 6-car to 5-car operation due to a decrease in ridership not only from the Covid Pandemic but also from changes in ridership patterns associated with LIRR's Grand Central Madison service. The B-Division estimates assume conversion of Franklin Av Shuttle to 4-car operation of 242-foot-long trains (subject to further study for infrastructure compatibility, since some of the platforms are only 175 feet long) and uniform 8-car C operation of 484-foot long trains. Specific service needs by line are indicated in the tables below (Subdivision B cars are in terms of 60.5-foot car length, since NYCT plans to replace all 75-foot cars with 60.5-foot cars).

Table 21: Projected Car Requirements – Division A [High Recovery Scenario]

PROJECTED CAR REQUIREMENTS FOR SERVICE: SUBDIVISION A High Recovery Scenario						
Line	Current Peak Trains Req. for Service	Additional Peak Hour Trains	Additional Shoulder Trains	2045 Peak Trains Req. for Service	2045 Peak Cars Req. for Service	Comments
1	31			31	310	
2	35	1		36	360	
3	25			25	250	
4	35			35	350	
5	35			35	350	
6	37			37	370	
7	38		1	38	418	Shoulder train recycled from AM peak
S	2			2	10	Reconfiguration to two 5-car trainsets
Total	238	1	1	239	2,418	

Table 212: Projected Car Requirement – Subdivision A [Mid Recovery Scenario]

PROJECTED CAR REQUIREMENTS FOR SERVICE: SUBDIVISION A Mid Recovery Scenario						
Line	Current Peak Trains Req. for Service	Additional Peak Hour Trains	Additional Shoulder Trains	2045 Peak Trains Req. for Service	2045 Peak Cars Req. for Service	Comments
1	31			31	310	
2	35			35	350	
3	25			25	250	
4	35			35	350	
5	35			35	350	
6	37			37	370	
7	38			38	418	
S	2			2	10	Reconfiguration to two 5-car trainsets
Total	238	0	0	238	2,408	

Table 23: Projected Car Requirements – Subdivision B [High Recovery Scenario]

PROJECTED CAR REQUIREMENTS FOR SERVICE: SUBDIVISION B High Recovery Scenario						
Line	Current Peak Trains Req. for Service	Additional Peak Hour Trains	Additional Shoulder Trains	2045 Peak Trains Req. for Service	2045 Peak Cars Req. for Service	Comments
A	38		1	39	390	
B	25			25	250	
C	18	2	2	22	176	
D	29			29	290	
E	26	3		29	290	
F	45			45	450	
G	13	2		15	75	
J Z	20			20	160	
L*	24	4		28	224	Assumes traction power upgrades
M	24			24	192	
N W	33			33	330	
Q	21			21	210	
R	31			31	310	
SR	3			3	15	
SF	3			3	12	Assumes conversion to 4-car units
Subtotal	**353**	**11**	**3**	**367**	**3,374**	
SAS II	-	14		14	140	SAS II conceptual requirements
Total	**353**	**28**		**381**	**3,514**	

*Two of the four additional trains for the L can be furnished from existing cars for 22tph L service.

Table 24: Projected Car Requirement – Subdivision B [Mid Recovery Scenario]

PROJECTED CAR REQUIREMENTS FOR SERVICE: DIVISION B Mid Recovery Scenario						
Line	Current Peak Trains Req. for Service	Additional Peak Hour Trains	Additional Shoulder Trains	2045 Peak Trains Req. for Service	2045 Peak Cars Req. for Service	Comments
A	38			38	380	
B	25			25	250	
C*	18	1		19	152	
D	29			29	290	
E	26	1		27	270	
F	45			45	450	
G	13	1		14	70	
J Z	20			20	160	
L*	24	1		25	200	Assumes traction power upgrades
M	24			24	192	
N W	33			33	330	
Q	21			21	210	
R	31			31	310	
S^R	3			3	15	
S^F	3			3	12	Assumes conversion to 4-car units
Subtotal	**353**	**4**	**0**	**357**	**3,291**	
SAS II	-	12		12	120	SAS II conceptual requirements
Total	**353**	**16**		**369**	**3,411**	

*Additional peak hour trains for the L and the C can be furnished from existing cars for 22tph L service.

3.3.4 Projected Spare Requirements

As noted earlier, NYCT's "spare factor" or ratio of "spare" cars to cars required for service has historically been in the range of 17-21%. For planning purposes, NYCT assumes a target spare factor of 17.5% for services operating on non-CBTC lines and 21% for services operating on CBTC lines. The higher spare factor associated with CBTC is due to the addition of CBTC signal equipment to the car fleet, which increases maintenance requirements associated with such equipment. Further only two lines – one B Division and the other A Division were CBTC equipped, which reduced the ability to move cars between lines.

As the rollout of CBTC expands throughout the system, NYCT anticipates that the CBTC-fleet spare factor can be reduced. Further, NYCT always looks to make improvements in maintenance planning to reduce the need for spares. However, cars are also becoming more complex, with more systems that can produce failures. Because NYCT anticipates that fleet purchases made prior to 2045 will accompany the completion of the CBTC rollout plan (i.e., all services are expected to operate with CBTC in whole or in part by 2045), this plan assumes 20% spares are required for every service.

Spares are calculated based on 20% of the number of units required for peak service, aggregated by shop and rounded to account for linking of trainsets into half-train-length units of four, five, or six cars. For example, Concourse Yard has a projected assignment of 290 cars, or 58 five-car units, for service. Providing 20% of the peak requirement for spares would total approximately 12 five-car units, or 60 cars. Projected spare requirements and total car requirements for each shop as of 2045 are as follows:

Table 25: 2045 Projected Total Car Requirements – Subdivision A [High Recovery Scenario]

2045 PROJECTED TOTAL CAR REQUIREMENTS: SUBDIVISION A High Recovery Scenario			
Shop	2045 Service Car Requirements	2045 Spare Car Requirements	2045 Total Car Requirements
Livonia - 5-car links	250	50	300
Livonia - 42 St S	10	10	20
239 St	360	75	435
240 St	310	65	375
Jerome	350	70	420
E 180 St	340	70	410
Pelham	370	75	445
Corona	418	88	506
Total	2,408	503	2,911*

*2911 is the final number of A-Division cars projected following the full retirement of the R142 car class, which may extend beyond 2045.

Table 26: 2045 Projected Total Car Requirements – Subdivision A [Mid Recovery Scenario]

2045 PROJECTED TOTAL CAR REQUIREMENTS: DIVISION A Mid Recovery Scenario			
Shop	2045 Service Car Requirements	2045 Spare Car Requirements	2045 Total Car Requirements
Livonia - 5-car links	250	50	300
Livonia - 42 St S	10	10	20
239 St	350	70	420
240 St	310	65	375
Jerome	350	70	420
E 180 St	340	70	410
Pelham	370	75	445
Corona	418	88	506
Total	2,398	498	2,896

Table 27: 2045 Projected Total Car Requirement – Subdivision B [High Recovery Scenario]

2045 PROJECTED TOTAL CAR REQUIREMENTS: DIVISION B High Recovery Scenario			
Shop	2045 Service Car Requirements	2045 Spare Car Requirements	2045 Total Car Requirements
Coney Island	930	175	1105
Concourse	290	55	345
East New York	576	128	704
207 St	188	36	224
Pitkin	405	100	505
Jamaica	1125	230	1355
Total	3514	724	4238

Table 28: 2045 Projected Total Car Requirements – Subdivision B [Mid Recovery Scenario]

2045 PROJECTED TOTAL CAR REQUIREMENTS: SUBDIVISION B Mid Recovery Scenario			
Shop	2045 Service Car Requirements	2045 Spare Car Requirements	2045 Total Car Requirements
Coney Island (S_F excluded)	910	170	1080
Concourse	290	55	345
East New York	552	120	672
207 St	164	36	200
Pitkin	395	95	490
Jamaica	1100	230	1330
Total	3411	706	4117

3.4 Related Initiatives & Investments

Various planned and proposed investments will impact car requirements in the 2045 time period. These include system expansion projects and proposed service changes. Major related investments are described below, as well as assumed impacts of these investments on service requirements and fleet needs.

3.4.1 System Expansion Proposals

Second Avenue Subway – Future Phases

Phase II of the Second Avenue Subway continues the line north from its current, temporary terminus at 96th Street, to a permanent terminus at 125th Street. This second phase includes stations at 106th, 116th, and 125th streets. At 125th St, the line would connect directly with the 4/5/6 trains at Lexington Avenue and Metro-North lines at Park Avenue.

When fully built, the Second Avenue Line will run from 125th Street in East Harlem to Hanover Square in the Financial District. Phase II is expected to open in late 2030. Phase II is expected to require 14 trains, plus spares. The implementation timeline for Phases III and IV to Lower Manhattan have not yet been determined. As such, only Phase II is reflected in the 2045 car requirements forecast.

3.4.2 Capacity Expansion – Rollout of Communications – Based Train Control

CBTC allows for increased capacity by allowing trains to safely operate in closer proximity to one another. Automatic Train Operation (ATO) also typically improves on-time performance, as more consistent operation allows for greater adherence to schedules. As of 2023, CBTC improvements are completed on the L and 7 lines and are nearing completion on portions of the E/F/M and R lines. Additional CBTC segments along the 8th Avenue corridor for the A/C and E lines are under

construction with an anticipated completion in 2026. The CBTC installation contract for the Crosstown line, used by the F and G routes, was recently awarded with an anticipated completion in Q3 of 2028. Contracts for the 6th Avenue and Fulton Street Lines (A/B/C/D/F/M) are expected to be awarded during the 2020-2024 program.

In conjunction with the construction of the CBTC signaling, NYC Transit is also undergoing fleet car modifications to enable full utilization of the new system. The R143 and R188 fleets have all been modified to facilitate the full use of the CBTC system for the Flushing and Canarsie Lines. The R179 and R160 Fleets are currently undergoing modification to accommodate CBTC on the Queens Blvd and the 8th Avenue Lines.

Table 29: Systemwide CBTC Rollout Proposal

SYSTEMWIDE CBTC ROLLOUT PROPOSAL		
Line	Anticipated In-Svc	Services Affected
Canarsie	In Service	L
Flushing	In Service	7
Queens Blvd West	2024	EFMR
Queens Blvd East	2026	EF
Culver	2025	F
Eighth Avenue	2027	ABCDEFM
Crosstown	2030	G
Fulton	TBD	AC
6th Avenue	TBD	BDF

3.4.3 Capacity Expansion – Open Gangway Configuration & Other In-Car Improvements

Increased passenger capacity is expected on new trains. The R211 trains feature 58- inch doors, which are eight inches wider than the R160 and most other train cars in the system. The current fleet of R142s have slightly wider doors than earlier A Division car classes but are still only 54 inches wide. Wider doors allow for increased boarding and alighting capacity which can help in decreasing dwell times at stations. Additionally, the new R211 fleet has an interior design that is more spacious by the doors to further improve boarding/alighting capacity. NYCT will also be testing the open gangway configuration on the R211 to determine its compatibility with NYCT systems and infrastructure and assess whether capacity improvements result from improved passenger flow within cars.

Chapter 4 Lifecyle Management – Maintenance & Replacement

Lifecycle management for railcars involves maintaining the fleet in a state-of-good repair throughout its useful life, normal replacement of cars at the conclusion of their useful life, and fleet growth and/or modification to the fleet to meet evolving service needs.

4.1 Maintenance

Subway car maintenance includes preventative maintenance procedures, unscheduled maintenance / emergency response and car cleaning.

- Preventative maintenance
- Unscheduled maintenance
- Car cleaning

NYC Transit's preventative maintenance practices are associated with the restoration of a subway car fleet to a state of good repair following a period of miles and mean distance traveled between failures (MDBF). On average the subway car fleet travels just under 300 million miles per year.

Table 30: Current Age and Planned Retirements by Car Class

CURRENT AGE AND PLANNED RETIREMENTS BY CAR CLASS						
Division	Car Class	Quantity	Years Purchased	Current Age	Currently Planned Retirement Year	Age at Retirement
A	R62	315	1984-1985	32-33	2025-2026	40
	R62A	824	1985-1987	30-32	2025-2027	40
	R142	1030	2000-2003	14-17	2040-2042	40
	R142A	220	2000-2005	12-17	2040-2044	40
	R188 Conv	380	2000-2005	12-17	2040-2044	40
	R188 New	126	2013-2015	2-4	2053-2054	40
B	SIR R44	62	1972-1974	43-45	2023-2024	53
	R46	752	1975-1977	46-48	2023-2025	48
	R68	425	1986-1988	29-31	2026-2029	40
	R68A	200	1988-1989	28-29	2028-2029	40
	R143	212	2001-2003	14-18	2041-2043	40
	R160	1662	2005-2008	9-12	2045-2048	40
	R211A	440	2018-2019	0	TBD	TBD
	SIR 211S	75	2023-2024	0	TBD	TBD

Figure 7: Average Yearly Fleet Mileage 2015 -2021

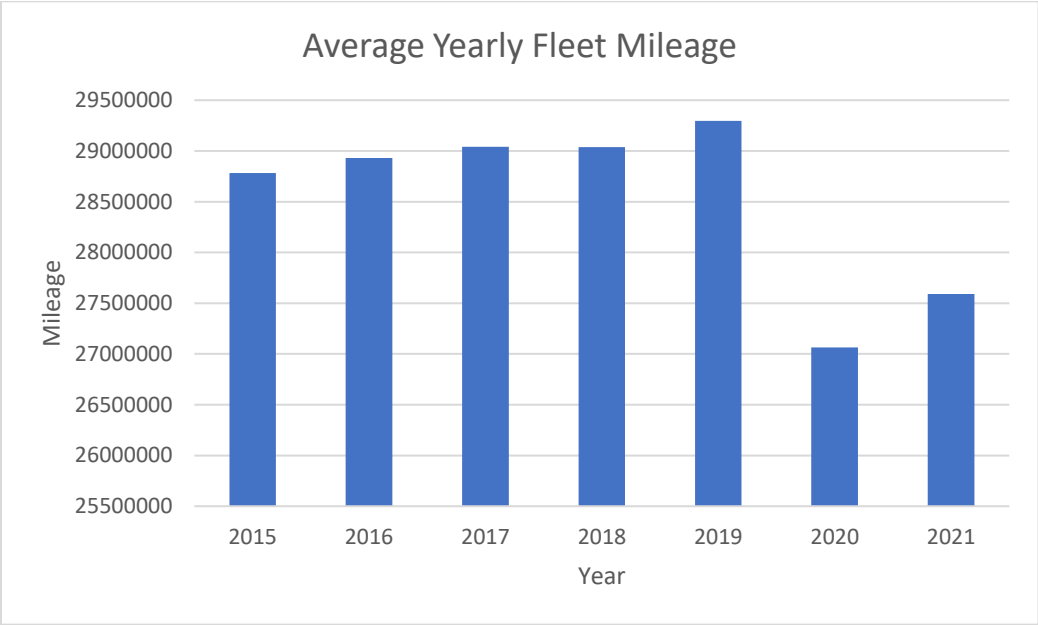


Figure 8: Average Yearly Fleet MDBF 2015-2021

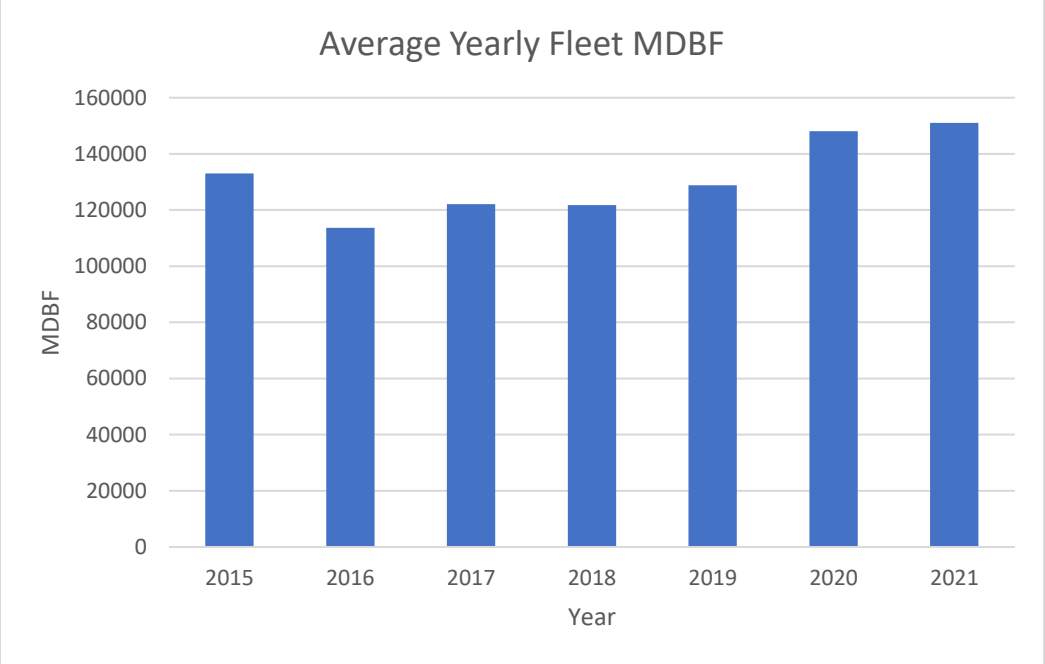
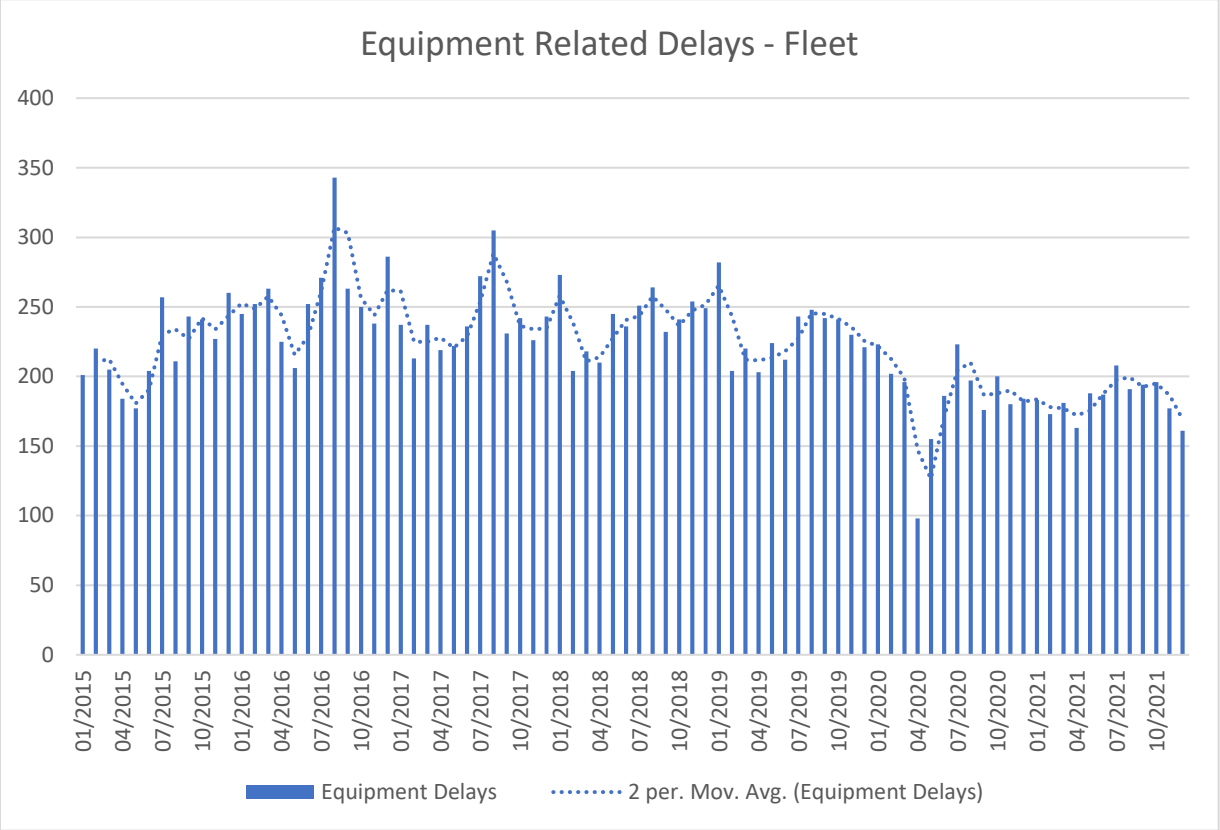


Figure 9: Equipment Related Delays 2015- 2021



4.1.1 SMI Program

The Scheduled Maintenance Inspection program is responsible for the day-to-day condition of the revenue fleet. These systematic inspections provide for periodic examination and service, including:

> (a) ensuring that fluid levels, lubricants, and other consumables are maintained and replaced as necessary
>
> (b) addressing minor wear and damage before major breakdowns occur,
>
> (c) eliminating dirt and other wear-causing contaminants, and (d) testing safety features to detect and correct any drop-offs in performance. The SMI program also satisfies manufacturer and car builder warranty standards.

All cars – except for the SIR R44 fleets – are inspected every 68-78 days or 10,000 to 12,000 miles, whichever comes first. SIR R44s (the oldest cars in the system) are inspected every 61-71 days or 9,000 to 11,000 miles. Each maintenance facility aims to ensure at least 80% of all cars are inspected within this window. The Timeliness of Inspection report is distributed monthly to document performance.

The SMI program utilizes a 4-cycle round of inspection. All systems are checked in each cycle, with 25% of longer-lifespan components given extended service on a rotating basis throughout each of the four cycles. As a result, every component is given full service approximately every 44,000 miles, and every car is inspected four to five times per year. Larger components with extended lifetimes are addressed in the SMS program.

Each inspection requires a 24-hour period involving three tours: the first tour (midnight) consists of high-pressure washing of condensers, vacuum cleaning of evaporators, and a general cleaning of under-floor equipment boxes. By removing steel dust from these locations, a thorough inspection is possible. The second tour (AM) is the inspection assessment itself. The third tour (PM) is the total cleaning of the interior car, as well as any post-inspection checklist work which was not completed during the AM shift. Minor defects and worn components are repaired or replaced as part of the inspection process. These are “extra” items. Defects requiring more extensive repairs, or too many “extras” to fix on the day of inspection, require the car to be held out of service until repairs are made.

Table 31: 2022 Inspection Planning

2022 INSPECTION PLANNING					
Shop	# of Cars	2022 Scheduled Mileage	Min # of Inspections Per Day (Time Based)	Min # of Inspections Per Day (Mileage Based)	2022 Avg. Scheduled Daily Inspections
239 St	385	23,668,663	8	9	10
240 St	390	20,376,599	8	7	8
Corona	540	21,666,952	11	8	8
East 180 St	400	19,532,456	8	7	8
Jerome	400	23,513,249	8	9	10
Livonia	320	16,121,928	6	6	6
Pelham	460	22,634,593	9	8	10
207 St	212	9,923,509	4	4	6
Coney Island	927	49,034,224	19	18	18
Concourse	268	18,245,204	5	7	8
East New York	644	31,660,237	13	12	12
Jamaica	1,084	65,354,277	22	24	26
Pitkin	388	25,439,619	8	9	10
Total	6,418	347,171,510	128	126	140

4.1.2 SMS Program

The Scheduled Maintenance System (SMS) is a planned heavy maintenance program designed to maintain state of good repair and increase car reliability through the pre-failure replacement of key components. Increasingly, SMS emphasizes component overhauls and upgrades due to the rapid pace of technological innovations.

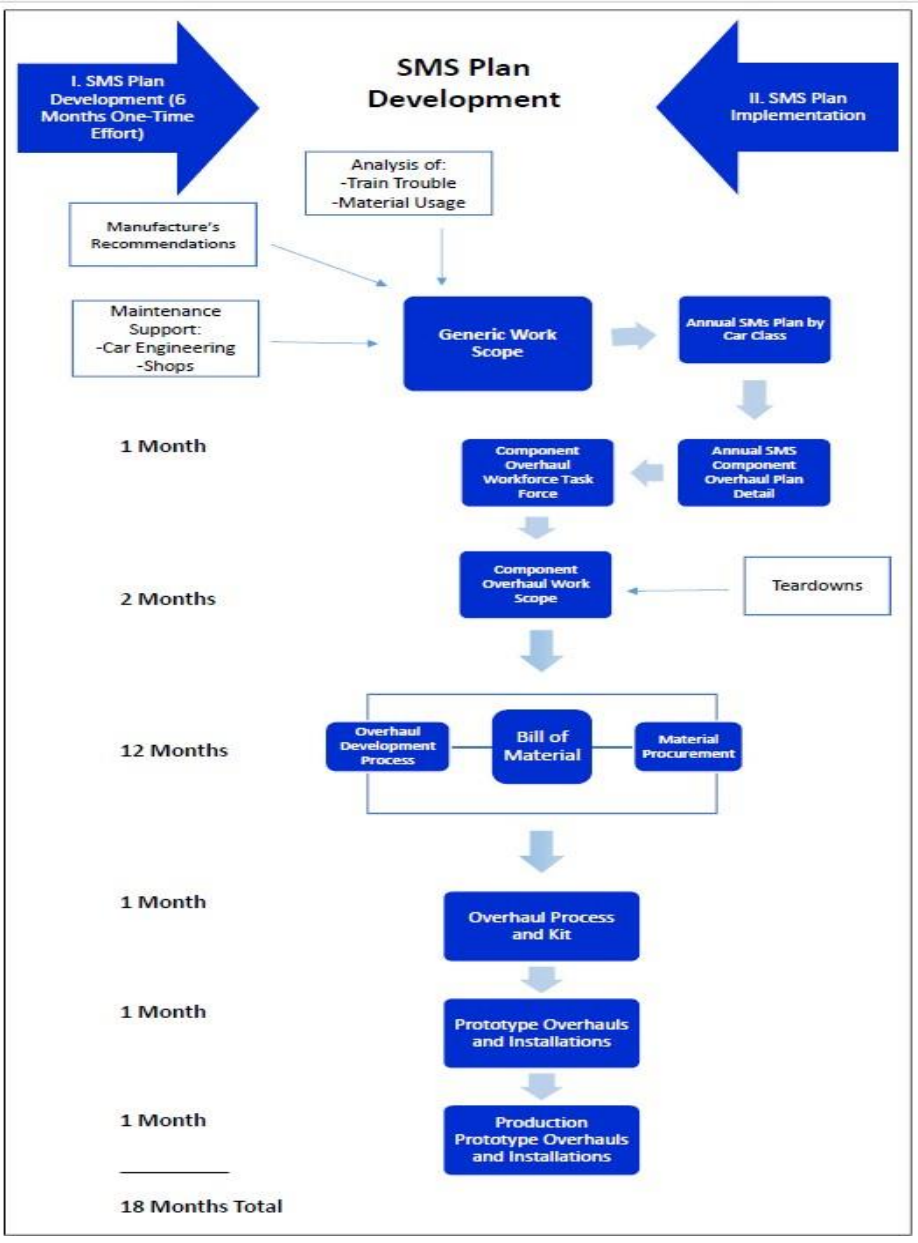
The SMS Programming varies slightly by fleet, but generally consists of three cycles:

- 4-year or 5-year SMS: Overhaul of air brake operating unit valves, load sensor valve, cab emergency magnet valve, and battery reconditioning
- 6-year SMS: overhaul of truck, brake valve, coupler, HVAC, and air compressors
- 12-year SMS: overhaul or replacement of draft gear, coupler, sign curtain, flooring, convertor, horn, door operators, car body hoses, master controller, public address system, and auto fault circuit reset. The 12-year SMS also includes the above-mentioned 4/5- year and 6-year SMS scope.

The Division of Car Equipment oversees the SMS planning process which determines the frequency and work scope of each maintenance cycle. It draws upon train trouble analyses, engineering analyses, manufacturer recommendations, and selective physical teardown and inspection of components. Based on these inputs, the frequency and scope are adjusted as warranted for each fleet.

New car procurements include various contractually required deliverables to support the SMS program. These include training, parts, tools, and test equipment. These contracts also include provisions for spare overhaul parts, which are expected to be replaced at planned intervals and once replaced, are expected to be remanufactured, overhauled, or reconditioned for further use. NYC Transit's goal for SMS performance is 100% compliance with each annual SMS Plan.

Figure 10: SMS Plan Development



4.1.3 Unscheduled Maintenance

Despite NYCT's best efforts to prevent equipment failures through scheduled maintenance, some unanticipated events do occur. Depending upon the type of failure, these may or may not affect revenue service. To address events that occur between planned inspections and component overhauls and replacement, unscheduled maintenance resources are required.

The response to an unanticipated equipment failure depends on the type of incident. The situation will be addressed by one or more of four groups: Emergency Response teams, maintenance facility repair teams, overhaul personnel, or pre-service inspection personnel based at train yards or terminals.

4.1.3.1 Emergency Response

DCE's Emergency Response subdivision responds to any equipment-related delays involving trains in revenue or non-revenue service. Its primary objective is to reduce delays by making running repairs, observing performance, and providing documents reporting defects to maintenance facilities. The Emergency Response group also assists with passenger evacuations, if required, and arranges for the transfer of defective trains to maintenance facilities for repairs, as necessary. Some Road Car Inspectors and Road Maintenance Supervisors are stationed at terminal locations and/or key stations to respond to incidents. Others utilize a fleet of motor vehicles strategically located to minimize response time.

4.1.4 Car Cleaning

Car cleaning facilities are located at 19 yards and 31 stations to support the NYCT goal of providing a clean passenger fleet. The Department of Subways performs three different types of car cleaning:

- Lay-up Car Cleaning - primary tasks, in addition to removing graffiti, adhesive stickers and gum, focus on a more thorough cleaning of interior of cars stored in the 23 yards and numerous lay-up areas at various locations throughout the system.

- Inspection Car Cleaning - provides a thorough cleaning of the interior after every scheduled inspection while in Maintenance Shop. Sweeping, mopping, and cleaning of surfaces with solvents is included.

- Terminal Car Cleaning - cleaning tasks at terminals includes removal of graffiti and adhesive stickers, sweeping, removing debris, and mopping up spills and standing water. The time to perform these tasks ranges from minutes during peak periods to over 10 minutes during off-peak periods. There are 31 terminal locations where car cleaning is performed, five to seven days per week, two to three tours per day depending on passenger flow and dwell time. (Car cleaning facilities at terminals are maintained by the Stations department, not DCE.)

Most car cleaning facilities at the stations and yards were built in the 1990s and are still in good condition overall. All locations have cleaning booths with material storage, slop sinks and eye wash stations, some have crew quarters, clock-in offices, material storage and/or trash compactors.

Note SIR utilizes a mobile car washer to upkeep its fleet. There are current plans for the 2025-2029 Capital Program to facilitate the build of a permanent car washer for the SIR fleet.

Table 32: Car Washers & Fleets Served

CAR WASHERS & FLEETS SERVED			
Car Washer	Year Placed In Service / Reno	Line(s)	No. of Cars Served
207 Street	1996	1 A C	980
239 Street	1966 / 2017	2 5	785
Canarsie	1991	L M J Z	644
Concourse	1964 / 1985	4 D	668
Coney Island	1968 / 2016	B N Q W S S	927
Corona	2006	7	560
Jamaica	1991	E F G R	1,084
Pelham	1966 / 2017	3 6 S	770

4.1.5 Facilities

4.1.5.1 Maintenance Shops

NYCT's fourteen maintenance shops support scheduled inspections, SMS component replacement, unscheduled car repairs, and car appearance tasks. Seven maintenance shops support A Division car classes, six support B Division car classes, and one supports SIR's fleet. In addition, the Central Electronics Shop (CES) services electronic components for all car classes.

A maintenance facility must also support the planning, administration and material/tooling with an onsite satellite storeroom required to operate any industrial facility. Each maintenance facility must keep up-to-date records for its employees and railcars, material requirements must be forecast and delivered including scheduling of daily and future operations, absences for employee training, random drug and alcohol testing must be coordinated with work assignments, all while controlling costs to keep within the operating budget. The building must also provide for the human needs of the workforce.

The maintenance facilities support scheduled inspection, component change-outs, implementation of car modification programs, and unscheduled car repair and car appearance tasks for its assigned fleet. Many activities, except for car cleaning, are carried out concurrently on separate tracks in the shop. Typically, each facility is headed by a Superintendent with Deputy Superintendents for Car Inspection, Car Repairs and Car Appearance.

Routine maintenance consists of performing both scheduled maintenance inspections and SMS work. For modification projects a unit may remain in the maintenance facility from five days to ten days, depending on the modification type. The average modification time is one day for each car in a unit, e.g., five days for a 5-car unit.

Unscheduled car repair occurs when an operating unit is taken out of service because of a problem that affects train operation (e.g. door controller or failed propulsion motor), safety (e.g. broken glass) or passenger comfort (e.g. faulty air conditioning).

Once a breakdown occurs in service and the train is returned to the facility for running repairs, a Car Repair team identifies the system(s) or component(s) that caused the failure and schedules the car(s) in to make necessary repairs and component replacements. The Car Repair unit also maintains records, identifies trends, and takes steps necessary to prevent a recurrence.

When a car has a problem that takes more than four days to correct the unit is sent to an overhaul facility where there is adequate space and heavy equipment to handle this type of work, see 4.1.5.2 below for more information on overhaul shop activities.

Figure 11: Map of NYCT Car Maintenance & Overhaul Shops

Car appearance tasks are performed immediately following scheduled inspection. During the PM and/or midnight shift several maintenance activities. Air conditioner filters, damaged/missing interior stickers and sacrificial window barriers are replaced. All interior surfaces and bonnets (that cannot be reached by a car washer) are cleaned. Air conditioner condenser and evaporator are steam cleaned on older fleets.

Table 33: Maintenance and Overhaul Facilities & Assigned Fleets

MAINTENANCE AND OVERHAUL FACILITIES & ASSIGNED FLEETS				
Shop	Division	Line(s)	Car Class	No. of Cars
180 Street	A	2 5	R142	415
207 Street (Overhaul)	B	A C	R160 R179	100
239 Street	A	2 5	R142	385
240 Street	A	1	R62 R62A	380
Concourse	B	D	R68	268
Coney Island (Overhaul)	B	B N Q SF	R46 R68 R68A	749
Corona	A	7	R188	560
East New York	B	L M J Z	R143 R160 R179	672
Jamaica	B	E F G R	R160	1,290
Jerome	A	4	R142 R142A	420
Livonia	A	3 S	R62 R62A	329
Pelham	A	6	R62A	430
Pitkin	B	A SR	R46 R179 R211A	494
Subtotal				6,463
Clifton	SIR	SIR	R44S R211S	69
Total				6,532

4.1.5.2 Overhaul Shops

DCE's two overhaul facilities carry out repair work which is too extensive to be performed at regular maintenance facilities. This generally includes the replacement of major components as part of 7-year and 14-year SMS overhauls; truck removal and replacement (which requires a 30-ton overhead crane); repair of severe damage caused by vandalism, fire, flood, or collision; or any repair work which would take more than four days in a maintenance facility.

Table 34: Functions at Overhaul Shops

FUNCTIONS AT OVERHAUL SHOPS	
Shop	Functions
207 Street	Maintenance Shop Overhaul Shop Car Repair Shop (including Paint Booth) Truck Shop (including Wheel Truing Machine) HVAC Shop
Coney Island	Maintenance and Overhaul Car Repair Shop (including Paint Shop) Truck & Wheel Shop (including Wheel Truing Machine) Pneumatic Shop Electric Motor Shop (including Battery)

The two overhaul facilities perform the level of car repair work that cannot be performed at the maintenance facilities. In general, the work that requires specialized equipment and takes extensive time to complete becomes the responsibility of the overhaul facilities. The role of the 207th Street and the Coney Island Overhaul Facilities are to support several functions including rehabilitation and repair of the railcar components and assemblies. Major car body repair and unscheduled large component replacements also happen at the overhaul facilities. Large scale scheduled maintenance for both revenue and work cars under the SMS Program and rail car conversions are planned at these facilities.

An overhaul facility also contains specialty workshops (i.e. house electrical and mechanical, carpentry, sheet metal, metal cutting, forming and forging) to fabricate the customized tools, parts and fixtures required by component and car repair shops as well as the maintenance facilities.

4.1.5.3 Yard Storage

The primary function of a rail yard is to provide secure storage for revenue trains and work equipment awaiting service deployment, cleaning, scheduled maintenance or repair. Safe storage of rolling stock not in service is necessary to deter acts of vandalism. Sufficient track space is also required for the storage of cars awaiting maintenance or inspection and for the timely release of trains into service. Some of the yards also serve as locations where train-operator and conductor trainees can acquire hands-on experience in train operation prior to being allowed to operate a train on the mainline, and where train testing (braking, accelerating) can be performed without disrupting revenue operations. All of the electrified-track yards have lead and storage tracks with their associated switches and signals, perimeter security fencing and lighting, and towers to control movement of trains within the yard.

The Department of Subways operates 23 yards located in all four boroughs of its operating network. There are nine yards in Brooklyn, six in the Bronx, and four each in Manhattan and Queens. Excluding Linden Yard (used only by work trains), 22 of these yards are categorized as rail car storage yards. Seven of the nine yards in the Subdivision A are located at the northern ends of the IRT lines in the Bronx and Manhattan. Corona Yard is at the end of the Flushing Line in Queens. Livonia Yard, the only Subdivision A Division yard located in the southern end of the system, is on the New Lots Avenue Line in Brooklyn.

Conversely, eight of the 14 Division B yards are at the southern end of the system in the borough of Brooklyn, with the remaining six yards in the other three boroughs. There are also numerous unsecured lay-up areas (not considered yards) at various locations throughout the system that are used to hold trains, mostly for cold weather storage but also for AM put ins.

A new railcar Acceptance and Testing Facility is currently under construction in Brooklyn with an anticipated completion for Q4 2025.

SIR operates three yards for its fleet including St George Terminal, Clifton Yard, and Tottenville terminal. SIR utilizes its two terminal stations as yard storage to alleviate the load on Clifton Shop and for continued system operation. Staten Island Railway stores most of its trains in the St. George Terminal which functions as both a yard and a terminal 24 hours a day. Additional storage is available at the Tottenville terminal, Clifton Yard, and Tompkinsville Siding. With the anticipate delivery of the new R211S fleet, no additional storage requirements are anticipated for the SIR service.

The yards vary widely in size, configuration, number of tracks, age, and overall condition. These variables can have a dramatic impact on the operating efficiency. Yard capacity in the 22 rail car storage yards is sufficient overall for the existing and immediate future. However, storage capacity in most yards (e.g. Jamaica Yard) cannot accommodate nightly storage of the assigned fleets in a yard. As a result, Subways lays-up 35-40 trains each night on the mainline in Manhattan, Brooklyn, and Queens. A plan to expand Jamaica Yard by an additional 24 tracks and a loop track to mitigate storage problems is currently in design and is due for award Q3 2024. Within the forecasted 20-Year needs, NYC Transit plans to invest in its aging maintenance facilities and additional storage space to facilitate continued daily operation and maintenance of the fleet.

Responsibility for the operation, maintenance, and yard repair is divided among the different operating divisions of the Department of Subways. Yard operations and movement of cars within the yard, as well as all train operator training functions, are performed and supervised by Service Delivery through the yard tower personnel. Maintenance and repair of track and switches in all yards are the responsibility of the Track Division, while signals and power are the jurisdiction of the Signals and Electrical Divisions of Maintenance of Way. The Division of Infrastructure in MOW maintains and repairs yard lighting, hydrant systems, and perimeter security fencing.

Table 35: Yard Storage Capacity

YARD STORAGE CAPACITY						
Subdivision	Yard	Borough	Lines Served	Yard Capacity (# of Trains)	Yard Capacity (# of Cars)	Shop Capacity (# of Cars)
A	137 St	Manhattan	1	10	100	-
	148 St	Manhattan	3	20	200	-
	180 St/ Unionport	Bronx	2 5	32	320	55
	239 St	Bronx	2 5	38	380	95
	240 St	Bronx	1	18	180	50
	Corona	Queens	7	25	275	50
	Jerome	Bronx	4	18	180	50
	Livonia	Brooklyn	2 3 4 5 S	17.5	175	40
	Westchester	Bronx	6	35	350	50
	Subtotal			213.5	2160	390
B	207 St	Manhattan	A C	38	410 (328)	150 (120)
	Av X	Brooklyn	F	17	170 (136)	
	Canarsie	Brooklyn	L	18	144	
	Coney Island	Brooklyn	B D F N Q S	61	610 (488)	105 (84)
	Concourse	Bronx	B D	36	360 (288)	25 (20)
	East New York	Brooklyn	L M J Z	10	80	56
	Fresh Pond	Queens	M	13.5	108	
	Jamaica	Queens	E F G R	29.5	295 (236)	80 (64)
	Pitkin	Brooklyn	A C S	36	360 (288)	50 (40)
	Rockaway Park	Queens	A C	8	80 (64)	
	Stillwell	Brooklyn	B D F N Q	31	310 (248)	
	Subtotal			530.5	2477 (2076)	466 (328)
SIR	Clifton	Staten Island	SIR	8	32	32
	St. George			5	20	20
	Tottenville			3	12	12
	Tompkinsville			3	12	12
	Subtotal			19	76	76
Total				763	4713 (2076)	932 (718)

4.1.5.4 Mainline Storage & Lay-Up Areas

In addition to the yard storage, trains are also stored in lay-up areas throughout the system. These lay-up areas are used to store trains for a variety of reasons including winter plans, gap trains, off-peak and put-ins. Lay-up tracks increase the flexibility of train service operations.

Table 36: Mainline Lay-up Areas

MAINLINE LAY-UP AREAS				
Subdivision	Location	Borough	Lines Served	# of Trains Stored
A	59 Street/Lexington Avenue Track 1A	Manhattan	4 5	0*
	Brooklyn Bridge, Tracks 1 & S	Manhattan	4 5	0*
	Dyre Avenue	Bronx	5	2
	Hudson Yards	Manhattan	7	6
	Nevins Street, Track M	Brooklyn	4 5	0*
	Subtotal			8
B	59 Street/4 Avenue Track F3	Brooklyn	R	5
	86 Street/4 Avenue	Brooklyn	R	1
	111 Street	Queens	J	2
	169 Street	Queens	F	3
	174 Street	Manhattan	F	2
	179 Street	Queens	E F	8
	Astoria Blvd, Track G3/4	Queens	N	3
	Broad Street	Manhattan	J	1
	City Hall	Manhattan	N	5
	Church Avenue	Brooklyn	G	5
	Coney Island	Brooklyn	R	6
	Continental Avenue	Queens	M R	11
	Kew Gardens, D4	Queens	E	4
	Parsons/Archer, Tracks D1 & D2A Upper	Queens	E	5
	Parsons/Archer, Track D3	Queens	M	6
	Parsons/Archer Track D4 Hillside	Queens	F	6
	Parsons/Archer, Lower Level	Queens	J	2
	Subtotal			75
Total				83

Note 59th Street/ Lexington Avenue, Brooklyn Bridge, and Nevins St. are used to turn Bad Order trains only.

Figure 12: NYCT Storage Yards

4.2. Facility Investment Needs

At present, approximately 46% of subway facilities/shops are in a state of good repair. NYCT's 2020-2039 Twenty-Year Needs Assessment identified $4 billion in projected needs for the shop asset category from 2015 – 2034. In the 2020 – 2024 Capital Program, approximately $300 million was allocated primarily for facility components repairs, equipment replacement and upgrades.

Moreover, as NYCT's New Millennium and CBTC-equipped fleets replace older fleets, reconstruction of shops such as Livonia and 240th Street will be needed to accommodate their additional maintenance needs.

Additionally, the investment pace for car maintenance facilities over the last few capital programs has been dampened as compared to the needs, due to budget constraints and prioritizing investments in the other asset categories. Since the 1990s only two maintenance facilities (East 180th Street awarded in 1994 and Corona in 2002) were completely rehabilitated or reconstructed. During the 1980s, capital investments were made in Jerome, Pelham, 239th Street, East New York, Coney Island and Jamaica Maintenance Facilities and the Coney Island Overhaul Facility complex. These investments were largely stop-gap investments to repair or halt serious deterioration and did not address shop configuration, sizing, or new technology car maintenance standards.

4.3 Normal Replacement Policy

NYCT's fleet replacement plan focuses on standardization of the Division B Fleet to a 60-foot fleet sizing in addition with the incorporation of CBTC equipment on the fleets running through a the updated signaling corridors. This standardization is to unify car configuration for more streamlined maintenance processes, to provide maximized passenger occupancy and flow on a whole-train basis, to better minimize platform gaps at curved platform stations, and to provide a standardized configuration to readily adapt to future service initiatives, such as platform screen doors. The standardization of Subdivision B car lengths is to be accomplished over several capital program periods, as legacy 75-foot car fleets (R46, R68, and R68A) reach the conclusion of their useful lives and are replaced with new fleets. This entails a necessary increase in the number of Normal Replacement railcars by 25% due to the increased number of cars to make equivalently sized trains.

NYCT is also advancing towards greater lifecycle-oriented replacement planning. As part of the adoption of Enterprise Asset Management (EAM) practices and systems throughout the agency, this may include relying more on commercial-off-the-shelf (COTS) parts, component-based replacements to extend railcar life, and whole lifecycle cost accounting to determine optimal replacement cycles.

NYCT policy calls for replacement of railcars at the conclusion of their design useful life of 40 years. Due to the extensive timelines for railcar procurement and delivery, unanticipated changes in short-term needs may result in modifications to the planned 40-year replacement cycle. Currently the R46 and the SIR R44 fleets are undergoing replacement with the continued delivery of R211 cars. The next fleets due for normal replacement are the R62/R62A and R68/R68As. Due

to expansion of the CBTC program on Division B, NYCT currently anticipates replacing the R68/R68A cars prior to the R62/R62A car, however, this is subject to change.

4.3.2 Disposal

NYCT retains contractors to complete the railcar disposal process. This includes removal, transport, asbestos remediation, reclamation of scrap metal, and disposal of the cars. The contractor is responsible for removing the cars from NYCT's property to complete environmental remediation, which includes removal and proper disposal of any potentially harmful materials including asbestos, oils, lights, and batteries. Scrap metal is also properly disposed of through materials recycling. Once completed, certification is provided to NYCT that removal and disposal of all environmentally harmful materials was completed in compliance with all city, state and federal laws.

4.4 Future Fleet Purchases

This section describes the numbers of train cars that will be needed to both replace aging cars and increase the fleet on the B Division to meet ridership needs described in Section 3 of this document. As NYCT is in the process of replacing the R44 and R46 fleets with orders of new cars that were made in 2018, the table below includes that purchase and runs until 2045.

The table below shows the number passenger vehicles needed by fleet in each year. Note that retiring cars occurs 1-2 years after accepting replacement cars.

Table 37: Projected Subdivision A & B Fleet 2018-2039

PROJECTED SUBDIVISION A FLEET	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
R62	315	315	315	315	315	315	315	315	315	315	315	315	315	315	75	0	0	0	0	0	0	0	0	0	0	0	0	0
R62A	824	824	824	824	824	824	824	824	824	824	824	824	824	824	824	660	420	180	0	0	0	0	0	0	0	0	0	0
R142	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1010	770	530	290
R142A	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	0	0	0	0
R188	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	506	266	0
R62/62A (NR) Awd 2025, maybe with option								AWD				10	250	490	730	970	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
R142/142A (NR)																			AWD				10	250	490	730	970	1250
High Growth Scenario (15)																									AWD			15
R188 (NR)																					AWD				10	250	490	506
Cars Retired (per year)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*240*	*239*	*240*	*240*	*180*	*0*	*0*	*0*	0	0	*240*	*240*	*480*	*506*
Cars Added (per year)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*10*	*240*	*240*	*240*	*240*	*170*	*0*	*0*	*0*	*0*	*0*	*10*	*240*	*250*	*480*	*480*	*311*
TOTAL SUBDIVISION A FLEET	2,895	2,895	2,895	2,895	2,895	2,895	2,895	2,895	2,895	2,895	2,895	2,905	3,145	3,385	3,385	3,386	3,316	3,076	2,896	2,896	2,896	2,896	2,906	3,146	3,156	3,396	3,396	3,201

PROJECTED SUBDIVISION B FLEET	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
R32	222	222	0																									
R42	50	50	0																									
R46 (expressed in 60’ car equivalents)	940	940	940	940	940	940	940	700	460	220	0																	
R68 (60’ car equivalents)	532	532	532	532	532	532	532	532	532	532	295	55	0															
R68A (60’ car equivalents)	250	250	250	250	250	250	250	250	250	250	250	250	65	0														
R143	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	212	0
R160	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662	1662
R179	132	298	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318	318
R211 Base (NR) + SAS Growth (460)	AWD			10	10	175	435	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460	460
R211 Option 1 (NR) Award 2022 (640)					AWD			305	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640	640
R211 Option 2 (NR) Award 2024 (435/437)							AWD		5	335	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435	435
R68/R68A (NR+Med Growth) Awd 2025 (388/390)								AWD				10	250	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390
High Growth Scenario (135)													AWD				10	135	135	135	135	135	135	135	135	135	135	135
R143 (NR) (212)																						AWD				8	212	212
Cars Retired (per year)	*0*	*0*	*272*	*0*	*0*	*0*	*0*	*240*	*240*	*240*	*457*	*240*	*240*	*65*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	*212*
Cars Added (per year)	*132*	*166*	*20*	*10*	*0*	*165*	*260*	*330*	*340*	*330*	*100*	*10*	*240*	*140*	*0*	*0*	*10*	*125*	*0*	*0*	*0*	*0*	0	0	0	*8*	*204*	0
TOTAL SUBDIVISION B FLEET	4,000	4,166	3,914	3,924	3,924	4,089	4,349	4,439	4,539	4,629	4,272	4,042	4,042	4,117	4,117	4,117	4,127	4,252	4,252	4,252	4,252	4,252	4,252	4,252	4,252	4,260	4,464	4,252

PROJECTED SIR FLEET	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
R44 SIR (75-ft cars)	64	64	64	64	64	64	64	0																				
R211 SIR (NR 60' cars) – Award 2018	AWD					5	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Cars Retired (per year)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*64*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0
Cars Added (per year)	*0*	*0*	*0*	*0*	*0*	*5*	*70*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0
TOTAL SIR FLEET	64	64	64	64	64	69	139	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75

Total NYCT Revenue Fleet	**6,959**	**7,125**	**6,873**	**6,883**	**6,883**	**7,053**	**7,383**	**7,409**	**7,509**	**7,599**	**7,242**	**7,022**	**7,262**	**7,577**	**7,577**	**7,578**	**7,518**	**7,403**	**7,223**	**7,223**	**7,223**	**7,223**	**7,233**	**7,473**	**7,483**	**7,731**	**7,935**	**7,528**

4.4.1 R211 & R44/R46 Retirement

New York City Transit's R211 project procures up to 1,612 railcars for the B-Division and Staten Island Railway. As originally conceived, this purchase replaced the R46 and SIR R44 fleets, purchased cars for Second Avenue Subway Phase 2, and expanded the fleet due to ridership increases.

The R211 cars will all be 60.5' in length. As such, the 752-car fleet of 75' R46 cars requires a 940-car fleet of 60.5' R211 cars for replacement. Though the number of cars in the fleet is increasing by 188, the number of 600' train sets (94) is unchanged. Similarly, the SIR requires 75 cars to replace its current R44 fleet. Thus 1,015 cars are needed for normal replacement. For SAS Phase 2, 170 cars are required including spares. The remainder of the purchase, 427 cars, was to be used for ridership driven expansion.

In 2018, NYCT laid out a plan to purchase R211 fleet with a base contract and two options. The base contract of 535 cars purchases 160 cars for fleet expansion for SAS Phase 2 and 375 cars for normal replacement. This purchase is in progress. R211 Option 1, which purchases 640 cars, was originally going to be a mix of normal replacement, SAS Phase 2, and ridership-based fleet expansion cars. However, when awarded in 2022, and due to the decline in ridership post Covid, NYCT switched the purpose of the R211 Option 1 to be for SAS Phase 2 and NR only.

Option 2, which purchases up to 437 cars, will be used to procure normal replacement cars for the R68 fleet and the remaining 10 cars for SAS Phase 2 expansion. NYCT is currently deciding whether to purchase only 5-car consists in Option 2 or to make it a mix of 4-car and 5-car consists. If only 5-car consists are chosen for purchase, Option 2 would buy 435 cars, if 4-car consists are included, then the purchase would be for 437 cars. We anticipate awarding Option 2 in 2024.

The R68/68A fleet normal replacement will be completed through a subsequent car purchase. For consistency, we have listed the number as either 388 or 390 depending on the consist composition in the R211 Option 2 purchase. This R68/68A purchase will include growth cars needed to meet the mid-recovery ridership scenario, with an option containing the 135 cars corresponding to the high-recovery scenario. Alternatively, the 135 high-recovery growth cars might be needed at a later date and be awarded as a stand-alone project or grouped into the R143 replacement project.

4.4.2 Additional Future Purchases

Looking out to 2035, there is one additional car purchase anticipated for A-Division cars to replace R62 and R62A cars, which may happen as early as 2025. Please note that in Table 37 we have designated three 2040-2044 car replacement projects. The exact years of these purchases and the numbers of cars received and retired per year for each of these purchases are placeholders reflecting our 20-year vision outlined in the Chapter 5. Finally, the high growth scenario for the A Division requires an additional 15 cars. These cars would not be purchased as a stand-alone project, but as we do not know if we will need them, we are representing them as a separate row on the table.

Chapter 5 Financial Summary

While numerous divisions across DOS, NYCT, and MTA provide support for management of the railcar fleet, the Division of Car Equipment (DCE) within the Department of Subways (DOS) manages and oversees the fleet at all stages of its lifecycle – from new car design, engineering, and production through recurring inspections, maintenance, and upgrades to normal replacement and disposal.

5.1 Overview of MTA Budgeting Procedures

Annual MTA budgeting is a rigorous and thorough on-going process which culminates each December with the passage of the MTA Budget. Each year, MTA prepares a February, July and November Financial Plan, and Adoption Materials in December. In addition to the updating the budget for the existing year, each Financial Plan requires MTA agencies to prepare four-year budget projections. Budget updates are made as follows:

- July Plan: The July Financial Plan provides the opportunity for the MTA to present a revised forecast of the current year's finances, a preliminary presentation of the following years proposed budget, and a three-year re-forecast of out-year finances. This Plan may include a series of gap closing proposals necessary to maintain a balanced budget and actions requiring public hearings. The Mid-Year Forecast becomes the basis in which monthly results are compared for the remainder of the year.
- November Plan: After stakeholders weigh in and the impact of new developments and risks are quantified, a November Plan is prepared, which is an update to the July Financial Plan. The November Plan includes a revised current year and finalization of the proposed budget for the upcoming year, as well as projections for three-years.
- Adopted Budget: In December, the November Plan is updated to capture further developments, risks and actions that are necessary to ensure budget balance and is presented to the MTA Board for review and approval.
- February Plan: Finally, in the Adopted Budget, below-the-line policy issues are moved into the baseline and technical adjustments are made. This results in what is called the February Plan. The Adopted Budget is allocated over the period of 12 months and becomes the basis in which monthly results are compared.

5.2 Twenty- Year Capital Needs Projection

Figure 13: Twenty Year Capital Needs Projection

Twenty Year Capital Needs Projection				
Railcar Division	2025 -2029	2030-2034	2035-2039	2040-2044
A Division	1,140 (NR) Replace R62/R62A			1,245 (NR) Replace R142/R142A 506 (NR) Replace converted R188
		1,245 Enable R142/R142A for CBTC		
B Division	343 (NR) Replace R68/R68A			212 (NR) Replace R143

Chapter 6 Asset Management Practices

6.1 Organization

The Vice President and Chief Mechanical Officer (VP/CMO) is responsible for the management of the Division of Car Equipment. This responsibility includes planning and developing the overall direction for the Division and managing its operations. The VP/CMO undertakes executive functions, administrative functions, and technical functions. DCE must make available daily a sufficient number of trains to meet service requirements. Periodic revisions to schedules made by Operations Planning (OP) require the VP/CMO to coordinate with the Division of Service Delivery and OP to establish the number of trains to be made available for service in accordance with the Service Plan. The VP/CMO also interfaces with Service Delivery on several operational issues including proper train storage, train rotation through the car wash, and movement between the maintenance shops and overhaul shops. The VP/CMO also approves the annual Scheduled Maintenance System (SMS) plan. Additionally, the VP/CMO is instrumental in the purchase of new rolling stock by developing and directing strategies for the acquisition and maintenance of new technology cars and, in working with CPM, securing capital funding for car purchases.

Under the direction of the VP & Chief Mechanical Officer, there are eight sub-divisions with various responsibilities:

- The "North" and "South" maintenance sub-divisions (serving Subdivisions A and B) clean and maintain the fleet to enable NYCT to meet its obligation to provide safe and reliable subway service.

- The Overhaul Shops subdivision provides scheduled heavy maintenance and running repairs of the fleet.

- The Emergency Response, RCC and Work Car unit responds to emergencies affecting service and manages the maintenance of the fleet of Non-Revenue equipment.

- The Engineering and Technical Support subdivision provides engineering support to DCE Shops, including establishment of maintenance standards and procedures, material standards, and project management of the new car procurement program for passenger and work cars.

- The Facilities, Industrial Certification, and Investigations subdivision ensures that maintenance facilities are constructed, maintain, and equipped to meet DCE's maintenance needs, controls chemicals used, manages a waste control program, and maintains the DCE's certifications for quality standards such as the American Association of Railroads (AAR).

- The Quality Assurance & Warranty Control subdivision manages the quality of internal and vendor processes and products, conducts audits and inspections of shop operations, and administers Warranties of all rolling stock procurements.

• Finally, the Operations subdivision coordinates production planning and scheduling, materials forecasting and control, and the implementation of the Enterprise Asset Management program within DCE.

6.2 Asset Management Systems

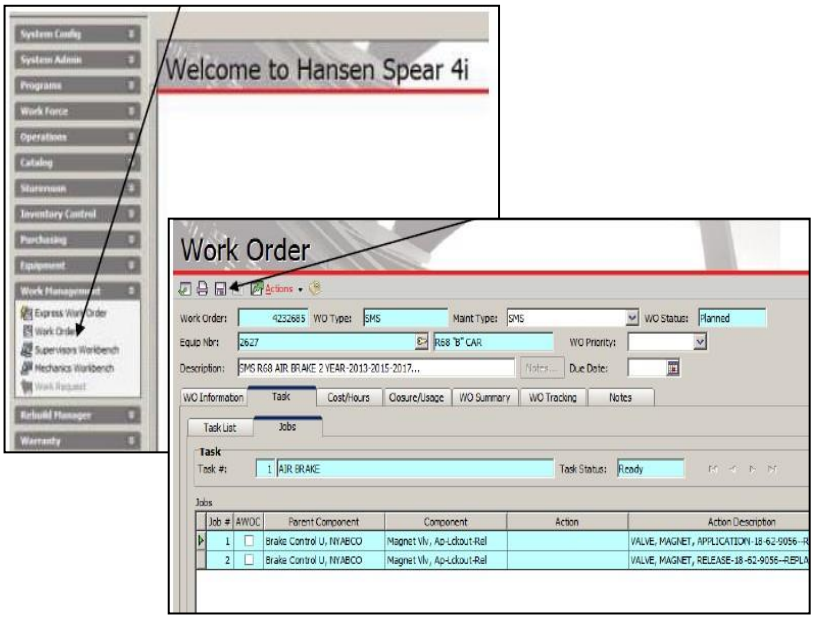
There are two primary systems utilized by the DOS to manage rail car assets. With the arrival of the new generation of subway cars, the Rolling Stock Management Information System (RSMIS) was implemented. RSMIS is an information management system designed to support all aspects of DCE's maintenance activities. In addition to RMSIS, the Uniform Capital Asset Inventory Database (UCAID) is an inventory management system designed to support Subways Capital Programs (CPS) in managing capital rail car (and other DOS) assets. DOS is currently implanting EAM across all the multiple divisions to house all capital and maintenance asset information in one centralized system. For Car Equipment, all assets are in EAM.

6.2.1 RSMIS

RSMIS supports the new generation of cars with such functions as maintaining car configuration data, managing warranty activity, tracking the performance and reliability of car subsystems and components, and building detailed maintenance and inspection histories for each car. DCE depends on the accuracy of the data in RSMIS to support a number of crucial business processes. RSMIS interfaces with some of the existing NYCT information systems including material management systems, ATS, reported mileage and train delay systems. This facilitates the systematic planning and execution of maintenance programs.

The RSMIS database has been expanded to include older car fleets and work equipment. Increasingly, RSMIS replaced the manual progress sheets used by maintenance facilities to track work orders for changing, modifying, or upgrading components on the older fleets (R32 through R68A).

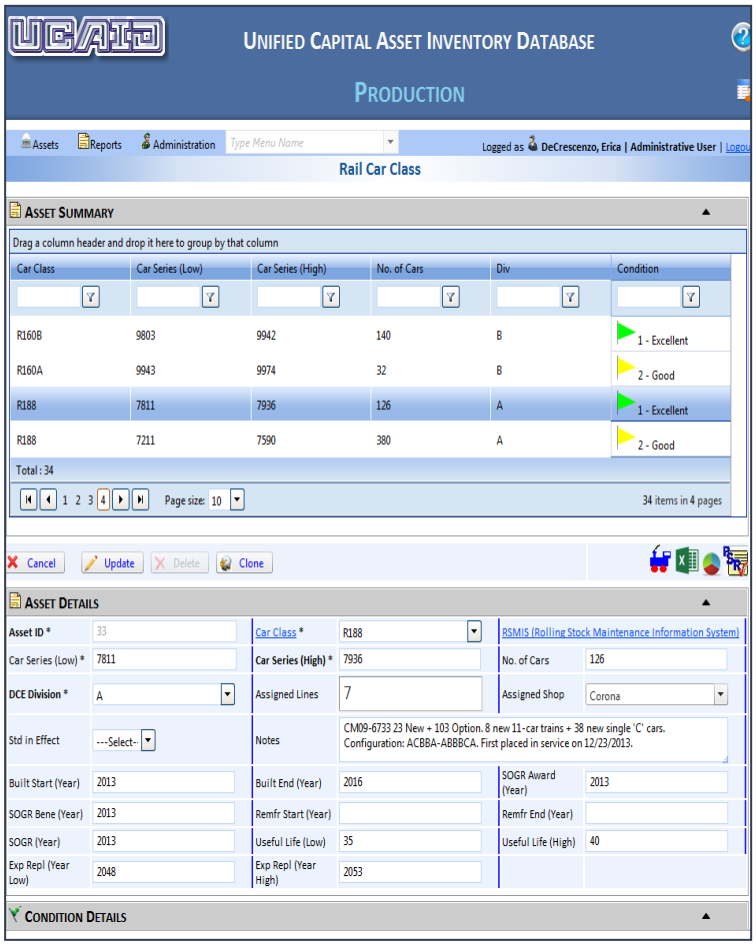
Figure 14: Screenshot of RSMIS Work Order Database



6.2.2 UCAID

The UCAID database was implemented in 2012. It contains an inventory of DOS' capital assets that were once in Excel spreadsheets but are now available on a Web-based desktop interface, updated directly by users. The database includes over 80 asset categories, condition ratings, useful life, and other asset details. Capital Programs utilizes this database for asset renewal and planning for the 20-Year Needs Assessment, 5-Year Capital Program, and for FTA reporting.

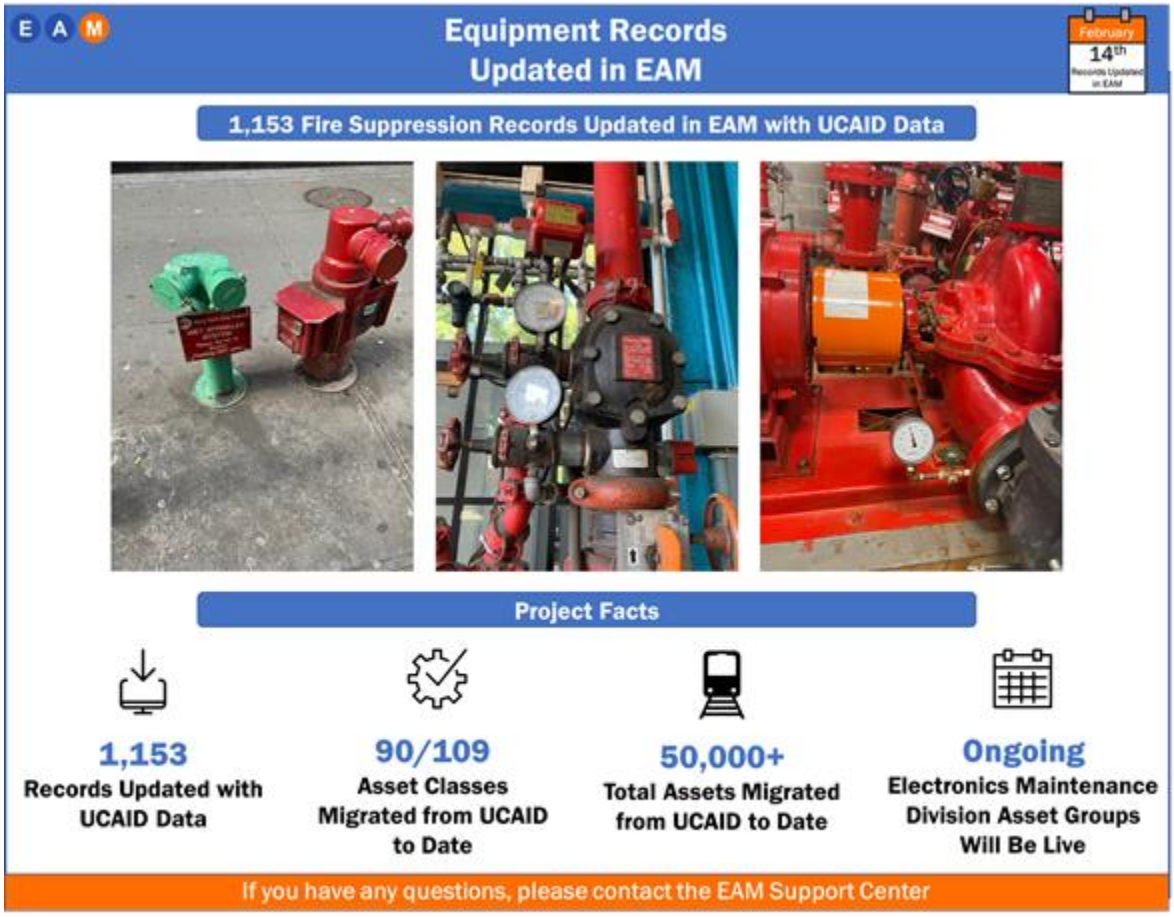
Figure 15: Screenshot of UCAID capital asset inventory



6.2.3 EAM

Department of Subways is currently migrating all its assets and data to the EAM all-agency software across all its divisions. The migration to EAM software is well underway with many asset categories. All DCE rolling stock assets and DCE Non-Revenue rolling stock have been migrated to the EAM software. Image below is screenshot of the R188 Fleet level record. There is an associated Asset record for every car in fleet with required UCAID data and condition migrated from UCAID.

Figure 16: Sample Equipment Record EAM


E A M
Equipment Records
Updated in EAM
February
14th
1,153 Fire Suppression Records Updated in EAM with UCAID Data
Project Facts
1,153
Records Updated with UCAID Data
90/109
Asset Classes Migrated from UCAID to Date
50,000+
Total Assets Migrated from UCAID to Date
Ongoing
Electronics Maintenance Division Asset Groups Will Be Live
If you have any questions, please contact the EAM Support Center

SUBWAYS PROD Environment
Work
Materials
Nonconformities (Defects)
Equipment
Operations
Reports
SUB PROD Environment | NYCT-DOS-DCE | C307053 | CE-QANCV
System 828947 CE-FLEET: R188
Record View
Comments
Events
Structure
Warranties
Documents
Nonconformities
Open Work Orders
Work Order Checklists
Checklists
Systen
More
System: 828947 CE-FLEET: R188
Notes: CM09-6733 23 New + 103 Option. 8 new 11-car trains + 38 new single 'C' cars. Configuration: ACBBA-ABBBCA. First placed in service on 12/23/2013, Series 7811-7936. CM09-6733 convert 10+370 R142A cars - Original Build 1999-2002, Series 7211-7590.
Common Name: R188
Alias:
Responsible Division: COR
Responsibility Center: 2560
Monitoring Division:
Borough:
Division: IRT
Organization: NYCT-DOS-DCE
Department: CE-DCE
Status: Installed-Functioning-In
Status Reason:
Status Note:
Status Change Date: 12/27/2022 11:31
Criticality: 3- Minor Delay to Opera
Equipment Details
Class: CE-FLEET
Category:
Safety:
Out of Service:
Profile:
System Level:
Assembly Level:
Component Level:
Component Position:
EMRS Description:
Equipment Configuration:
Equipment Configuration Revision:
Equipment Filter:
Commission Date: 01/01/2002
Original In-Service Date:
Latest Receipt Date:
Original Install Date:
Latest Install Date:
Decommission Date:
Dormant Start:
Dormant End:
Reuse Dormant Period:
Sold/Scrap Date:
Original Receipt Date:
Financial and Disposition Details
Custom Fields
Disposal Value:
T-Category: T-01
Exp Repl Year: 2030
FTA Funded:
SOGR Year: 1992
Sponsor Resp Center: 2500
Assigned Lines: 7
Car Series (High): 7,936
Car Series (Low): 7,211
Cars In Consist: 5
Cost Per Car Bid: 0
Cost Per Car Project: 1,363,359
No. of Cars: 506
Division: A
Exits Per Side: 3
Car Height: 142.625
Car Length: 616
Car Width: 102
Car Weight: 70,149
Notes:
Remanufacture Company: None
Remanufacture End:
Remanufacture Start:
Seating Capacity High: 40
Seating Capacity Low: 34
SOGR Award: 1,997
SOGR Bene: 2,002
Useful Life High (Yrs): 40
Useful Life Low (Yrs): 35
Expected Repl Yr High: 2035
Expected Repl Yr Low: 2030
Year Built End: 2016
Year Built Start: 1999
Cond Overall: 2
Cond Overall Date: 05/31/2017 10:51
Condition Notes:
Tracking Details
Manufacturer:
Manufactured Date:
Serial Number:
Model:
Revision:
Tag ID: R188
Legacy Tag ID:
Legacy System: UCAID
Legacy System ID: 34
Hierarchy
Documents

Chapter 7 Plan Improvement & Monitoring

7.1 Timeliness of Inspection

The timeliness of Inspection Report indicates the percentage of inspections completed early, on-time, or late. Late inspections may be due to time-based inspections requirements (i.e., # of days between inspections) or mileage-based inspection requirements (i.e., # of miles between inspections).

Table 38: June 2023 Timeliness of Scheduled Maintenance Inspections (SMIs)

June 2023 TIMELINESS OF SCHEDULED MAINTENANCE INSPECTIONS (SMIs)								
Shop	Class	Early		On-Time		Late		Total
		Inspection	%	Inspection	%	Inspection	%	Inspections
180th Street	R142	0	0%	141	90%	14	9%	155
239th Street	R142	0	0%	190	94%	0	0%	190
240st Street	R62A	7	4%	158	90%	5	3%	170
Corona	R188	0	0%	209	100%	0	0%	209
Jerome	R142	5	5%	95	89%	10	9%	110
Jerome	R142A	15	17%	75	88%	0	0%	90
Livonia	R62	0	0%	130	92%	0	0%	130
Livonia	R62A	0	0%	6	96%	0	0%	6
Pelham	R62A	6	3%	179	94%	0	0%	185
A-Div Total		33	3%	1,183	95%	29	2%	1,245
207th Street	R179	0	0%	67	100%	0	0%	67
Coney Island	R46	0	0%	128	73%	48	27%	176
Coney Island	R68	0	0%	54	76%	17	24%	71
Coney Island	R68A	0	0%	56	88%	8	13%	64
Concourse	R68	12	10%	116	91%	0	0%	128
East NY	R143	8	0%	72	86%	4	5%	84
East NY	R160	0	0%	164	91%	16	9%	180
East NY	R179	0	0%	24	100%	0	0%	24
Jamaica	R160	0	0%	450	83%	95	17%	545
Pitkin	R179	0	0%	55	100%	0	0%	55
Pitkin	R46	0	0%	148	95%	8	5%	156
B-Div Total		20	1%	1,334	86%	196	13%	1,550
FLEET TOTAL		53	2%	2,517	90%	25	8%	2,795

Appendix I: Glossary

A Car – The car located at each end of an Operating Unit that contains the operating cab

Anti-climber – A structural reinforcement at each car end to discourage adjacent cars in an end-to- end collision from overriding each other

Automatic Stop Arm – A wayside mechanical device that places the passing car in emergency braking when activated by the signal system

Automatic Train Control and Cab Signaling (ATC) – An operating mode where a target speed is displayed to the Train Operator and penalty braking applied if that speed is exceeded

Auxiliary System – Any mechanism or structure, other than the car body and propulsion system which functions during car operation (door operators, lighting, HVAC, communications, etc.)

B Car – A non-cab car located between A Cars

BMT – Brooklyn-Manhattan Transit Corporation, one of the two original private operators of the NYC Subway system purchased by the City in 1940 and absorbed into the NYCT network; BMT lines are part of Subdivision B

Braking, Dynamic – Braking in which power generated by traction motors, when driven as generators, is either dissipated as heat by brake resistor grids or returned to the third rail as regenerative electrical energy

Braking, Emergency – Braking that results in an irrevocable friction braking effort to a stop

Car Washing Facilities – Perform exterior car cleaning; there are 8 Car Washing Facilities across the NYCT system

Communications-Based Train Control (CBTC) – An automatic train control system, comprised of wayside and on-board vital processors and a high capacity, bi-directional, radio-based train-to-wayside communications network; currently only New Technology Cars can be modified to accept CBTC equipment

Contact Rail – A third rail located outside the running rails which supplies the external source of 600 VDC electrical power

Current Collector – A car-borne device to conduct electrical power from the contact rail to the car

Daily Material Holds – Cars may be held following inspection due to unavailability of replacement parts

Deadman Control – A mechanically initiated device to detect inattention or disability of the Train Operator

Dispatching – The process of placing a train into revenue service

Division of Car Equipment (DCE) – Maintains all revenue and non-revenue equipment across the NYCT subway system

Dwell Time – The total time from the moment a train stops at a station until it begins moving again

Emergency Response – A DCE group focusing on running repairs, observing performance, and providing documentation reporting defects to maintenance facilities

Enterprise Asset Management (EAM) – A program addressing the optimal lifecycle management of NYCT's physical assets

Express/Local Service – Trains operate on parallel tracks, with local trains making all stops and express trains making express stops only; express/local service may operate in a four-track, three-track peak direction, or zoned configuration

Frequency Guidelines – Establish minimum service frequencies known as Policy Headways

Headway – The time separation between two trains, both traveling in the same direction on the same track

IND – Independent Subway, the system of Subway lines built by the City and operated under public control from their inception; IND lines are part of Subdivision B

Inspection Car Cleaning – Provides a thorough cleaning of the interior while cars are in a Maintenance Shop after inspection including sweeping, mopping, and cleaning with solvents

Interval – A scheduled train, typically referenced using the terminal and scheduled departure time

IRT – The Interborough Rapid Transit Corporation, one of the original private operators of the NYC Subway purchased by the City in 1940; the IRT opened the first underground Subway line in 1904 and its former services make up what is now Subdivision A

Lay-up – Short-term storage of trains between peak periods or under special circumstances such as service changes due to construction or inclement weather; lay-ups may occur in a yard or mainline location such as a third or pocket track not required for regular service

Lay-up Car Cleaning – Includes graffiti, adhesive sticker, and gum removal and provides a thorough clean of cars when they are stored at yards or lay-up locations

Legacy Car – Cars built before the 1990s that include primarily analog systems; these cars cannot be converted to CBTC operation

Loading Guidelines – Determine how much subway service should be provided, based on the number of customers on a train at the route's busiest point

Long Term Holds/Collisions – Cars held for longer than 30 days for difficult-to-find replacement parts or involvement in a collision

Maintenance Shops – Support scheduled inspections, some SMS component replacement, unscheduled repairs, and car appearance tasks; there are 14 Maintenance Shops across the NYCT system

Mean Distance Between Failures (MDBF) – The mileage logged, on average, by members of a car class between component failures resulting in a train delay; typically measured over a set time period, e.g. one year

Mean Distance Between System Component Failures MDBSCF – The ratio of the total operating distance accumulated by the total population of cars in a car class to the total number of relevant failures occurring for the population of components within each specified system of the cars in the class; typically measured over a set time period, e.g. one year

Modifications – Special campaigns to modify or upgrade car systems or components

New Technology Car – Cars built in the 1990s or later; these cars include many digital systems and are capable of being modified for CBTC operation on lines where the necessary wayside infrastructure has been implemented

Operating Unit or Unit – A group of semi-permanently coupled cars, with an A car at each end

Open Gangways – A type of car design that eliminates doors between cars in Operating Unit allowing passengers to freely move throughout the consist

Operations Planning – The NYCT division that handles the planning of subway and bus service as well as forecasting future service needs

Overhaul Shops – Shops that handle SMS work and most other substantial repairs which would take more than 4 days to complete in a maintenance shop including truck replacement and maintenance requiring a 30-ton overhead crane; Overhaul Shops are located at the 207th Street Complex in Manhattan and Coney Island Complex in Brooklyn

Policy Headways – Minimum subway service frequency, measured over one hour, which vary based on the time of day and day of the week

Regenerative Braking – Process of returning the braking energy of the Operating Unit to the third rail power system through the conversion of kinetic energy to electrical energy; only available on New Technology Cars

Route Design Guidelines – Determine the proper application of different routing patterns (e.g. through local, express/local, skip-stop, shuttle) for subway lines

Scheduled Maintenance System (SMS) – Includes several distinct cycles of heavy maintenance performed in NYCT Overhaul Shops

Scheduled Maintenance Inspections (SMI) – Requires cars to undergo routine inspection and light maintenance on a periodic cycle

Service Change Guidelines – Specify the process for making major and minor changes to bus and subway service, such as changes in routing, stop patterns, and/or hours of service

Service Failure – A failure which causes a train to be removed from service, including preventing a scheduled entry into service

Shell – Part of the car body composed of roof, sides, end and underframe structure, floor and sheathing but devoid of any interior finish, windows, doors, and exterior accessories

Shuttle Service – Trains operate on a branch line and terminate at a transfer point to a through service

Skip-stop Service – Trains with two separate designations operate on the same track in two stopping patterns; some stations are served by one train, some are served by the other, and some are served by both

Spare Factor – Ratio of spare cars to cars required for service; historically 17-22%

Spares, Reserve – Spare cars than can be placed into service at a given time and are not undergoing maintenance or inspections

Spares, Unavailable – Spare cars that cannot be placed into service at a given time due to ongoing scheduled or unscheduled maintenance or inspections

Subdivision A – Consists of the former IRT services, includes all numbered lines and the 42nd Street Shuttle

Subdivision B – Consists of the former BMT and IND services, includes all lettered lines and the Franklin Avenue and Rockaway Park Shuttles

Subdivision C – Consists of work/non-revenue equipment and flagging personnel, generally is not used to refer to physical right-of-way

Subway Action Plan – A program of improvements for NYC Subway operations proposed by MTA Chairman Joseph Lhota in July 2017 which will be implemented in two phases

Terminal Car Cleaning – Provides a basic cleaning including graffiti and debris removal, sweeping, and mopping up spills while cars are at terminal stations between intervals; this is accomplished over the course of a few minutes

Through Local Service – Trains operate to/from Downtown Brooklyn or Manhattan, stopping at all stations

Throughput – The number of trains passing through a given location over a given time interval, typically measured in trains per hour (tph)

Track Tests – Annual requalification testing required for all cars with microprocessor-regulated propulsion controllers (R32, R42, and R46 car classes); track tests may also be scheduled following major component repair or modification

Traction Power – The system of 600V DC power delivered to a train's traction system through the third rail and associated infrastructure of substations, feeder cables, circuit breakers, etc.

Traction System – The system of wheels, motors, driving mechanisms, brakes, and direct controls that propels or retards an Operating Unit

Train – A configuration of cars to be used in revenue service

Train Conductor – The individual who normally occupies a cab in the middle of the train and is responsible for performing functions necessary for controlling and monitoring side doors

Train Operator – The individual who normally occupies the head end cab of a train and is responsible for performing functions necessary for train movement and monitoring

Unscheduled Holds – Cars may be held in a maintenance facility because they require unscheduled repairs or inspections exceeding one day

Yards – Storage locations for revenue and non-revenue equipment addressing both short and long-term needs; there are 23 yards across the NYCT system